MANDIBULAR SYMPHYSIS GRAFT VS ILIAC CORTICAL GRAFT IN RECONSTRUCTING FLOOR IN ORBITAL BLOW OUT FRACTURE - A COMPARATIVE STUDY

Dissertation submitted to

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Towards the partial fulfillment for the degree of

MASTER OF DENTAL SURGERY

BRANCH-III

ORAL AND MAXILLOFACIAL SURGERY

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CERTIFICATE

This is to certify that ***Dr.G.L.ANITHA****, P.G. Student (2008-2011) in the Department of Oral and maxillofacial surgery, Tamilnadu Government Dental College and Hospital, Chennai-600 003, has done* dissertation *titled "****Mandibular symphysis graft Vs Iliac cortical graft in reconstructing floor in Orbital Blow Out fracture -A Comparative study"*** *under our direct guidance and Supervision in partial fulfillment of the regulation laid down by The Tamilnadu Dr.M.G.R. Medical University, Chennai, for MDS, Branch-III, Oral and Maxillofacial Surgery Degree Examination.*

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Last but not the least I would like to seek the ***blessings of the Almighty*** *without whose grace this endeavour wouldn't have been possible.*

DECLARATION

I, **Dr. G.L.ANITHA**, do hereby declare that the dissertation titled "**MANDIBULAR SYMPHYSIS GRAFT VS ILIAC CORTICAL GRAFT IN RECONSTRUCTING FLOOR IN ORBITAL BLOW OUT FRACTURE -A COMPARATIVE STUDY"** was done in the Department of Oral and Maxillo Facial Surgery, Tamil Nadu Government Dental College & Hospital, Chennai 600 003. I have utilized the facilities provided in the Government dental college for the study in partial fulfillment of the requirements for the degree of **Master of Dental Surgery** in the speciality of Oral and Maxillo Facial Surgery **(Branch III)** during the course period **2008-2011** under the conceptualization and guidance of my dissertation guide**, Prof. Dr. G. UMA MAHESWARI, MDS.**

I declare that no part of the dissertation will be utilized for gaining financial assistance for research or other promotions without obtaining prior permission from the Tamil Nadu Government Dental College & Hospital.

I also declare that no part of this work will be published either in the print or electronic media except with those who have been actively involved in this dissertation work and I firmly affirm that the right to preserve or publish this work rests solely with the prior permission of the Principal, Tamil Nadu Government Dental College & Hospital, Chennai 600 003, but with the vested right that I shall be cited as the author(s).

Signature of the PG student *Signature of Guide & Head of the department*

Signature of the Head of the Institution

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Telephone No : 044 2534 0343
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R.C.No. 0431/DE/2010

Date:01.06.2010

Title of the Work : Mandibular Symphysis graft Vs iliac Cortical graft in reconstructing floor In Impure Orbital Blow out fracture – a comparative study.

Principal Investigator: Dr.G.L.Anitha, II year MDS

Department : Dept of Oral & Maxillofacial Surgery
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The request for an approval from the Institutional Ethical Committee (IEC) was considered for the following on the IEC meeting held on 22.04.2010 at the Principal's Chambers, Tamil Nadu Government Dental College & Hospital, Chennai-3.

"Advised to Proceed with the study"

The Members of the Committee, the Secretary and the Chairman are pleased to approve the proposed work mentioned above, submitted by the Principal Investigator.

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10. Your work should be carried out under the direct supervision of your Guide/Professor.

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01/06/10

CHAIRMAN

INTRODUCTION

"The eye is the jewel of the body and mirror of the soul"

– Henry David Thoreau

Possibly no other area of the face than the eyes are under such constant dynamic and social scrutiny, as they are the first to gain attention in the face and remain the focus of the onlooker. The face being an anatomically and functionally complex area has to be reconstructed in the most physiological and aesthetic manner following trauma or ablation.

Maxillofacial trauma has become the commonly reported casualty in our country due to the rising rate of road traffic accidents and acts of interpersonal violence. Orbital fractures represent one of the commonest conditions encountered in maxillofacial trauma, be it the blow out fracture or as part of complex fractures.

Though the first recorded description of a case of orbital blow out with enophthalmos was made by Lang in 1889, the term "Blow out fracture" was coined by Smith and Regan in 1957[62]. Smith describes the term as "fracture of the floor of the orbit which may be accompanied by displacement of the orbital contents into the maxillary sinus". In 1960 Converse and Smith introduced the

concept of Pure and Impure Blow out fracture[11],based on association of rim fracture. Blow out fracture results in esthetic deficits including Enophthalmos, Hypoglobus, dystopia and functional deficit including diplopia , restricted ocular movements & Infraorbital nerve paraesthesia.

The goals of reconstruction of fractures of the orbital floor are to free the incarcerated or prolapsed orbital tissue from the fracture defect and to span the defect with an implant to recover the volume of the orbital cavity and rectify the position of the eyeball. Numerous materials have been tried including autogenous, alloplastic and allogenic materials but with none fulfilling all the ideal properties. Various authors have advocated the use of autogenous grafts from sites such as Calvarium, Auricular cartilage, Nasoseptal cartilage, Anterior wall of maxillary sinus, Contralateral Coronoid Process, Mandibular symphysis, Rib and Ilium. The choice of the graft depends on the size of the defect, location of defect, curvature of orbit in the region, condition of lining sinus and donor site preference.

Iliac bone is comparable to Calvarial bone in the immediate and secondary repair of orbital wall deformities following blow out fracture. Iliac bone is easy to harvest, and the medial cortex of the anterior iliac crest is relatively easy to shape to fit the internal orbital wall[53]. Few studies are available concerning immediate

reconstruction with Iliac bone according to which good aesthetic and functional results can be achieved[1,53].

Mandibular symphysis is a reliable intraoral site for harvesting graft, with strong and thick cortical bone available. The site is currently widely used as donor site for grafting in ridge augmentation for dental implant placement. But it has not been widely studied as donor for orbital floor reconstruction. Vejayan Krishnan and James V Johnson (1997)[67] substantiates the usefulness of Mandibular symphyseal graft for floor defects less than 2 cm diameter. Andre Montazem (2000) [2] stated that the average bone volume available from mandibular symphysis is 4.84ml & 4.71ml .

This prospective study intends to evaluate and compare the efficacy of mandibular symphysis graft and iliac bone graft in restoring the orbital floor defect in orbital blow out. Also the volumetric correction of orbital defect using both grafts is compared using computed tomography.

AIM OF THE STUDY

To compare and assess the outcome and versatility of mandibular symphysis graft and Iliac cortical graft in orbital floor reconstruction in orbital blow out fracture.

The study also aims to assess the correction of enophthalmos - the volumetric correction of orbit with both grafts using computed tomography.

SURGICAL ANATOMY OF THE ORBIT(Color plate I)

The orbital region can be divided into 4 basic components: bony orbit, periocular soft tissues, the globe, and the protective soft tissue apparatus consisting of the eyelids & lacrimal apparatus.

The bony orbit comprise of the bones: Zygoma, Maxilla, Lacrimal bone, Frontal, Ethmoid, Palatine & sphenoid. The orbital walls form a pyramid with optic foramen at its apex.The medial wall is the thinnest, as thin as 0.2-0.4 mm, made of Ethmoid bone(paper plate).The floor is thinnest medial to the infra orbital groove & canal(0.5mm).The floor & medial wall are supported by shock absorbers in the form of Maxillary & Ethmoid sinuses which are acute volume expansion compartments.

- The floor is concavo convex antero- posteriorly with no distinct border medially. Orbital floor behind the orbital rim is initially concave until a point just behind the equator of the globe.
- It becomes convex upwards inclining at around 30 degrees creating retrobulbar constriction in the orbit.
- Combined with this is the 45 degree inclination from the lateral to the medial wall, an postero medial and infero medial bulge, a region called the ***Hammer's Key area***, important in graft placement for correcting enophthalmos.

- It continues posteriorly to terminate as the anterior margin of inferior orbital fissure, at this point the bone curves smoothly but abruptly downward.

Rontal et al (1979)[16] studied 48 orbits in 24 skulls and determined the relation of important structures that limits dissection, to well defined landmarks.

Landmark	**Safe to dissect until**
Inferior orbital rim	25 mm
Anterior lacrimal crest to floor	30 mm
Anterior lacrimal crest to optic canal	42 mm
Infra orbital foramen to midpt IO fissure	24 mm

SURGICAL ANATOMY OF THE ILIUM (Color Plate II)

The **hip bone** has the appearance of a propeller with a large, sinuous blade (**Ilium**) directed upwards and a smaller blade, perforated by a large aperture (**Obturator foramen**) directed downwards. The **Ilium** is concave-convex in all dimensions; medio-lateral (ML), anterior-posterior (AP) and superior-inferior (SI). This contour limits bone harvesting to the anterior one-third or posterior one-third[52].The **Anterior Iliac crest** is located between the anterior superior iliac spine (ASIS) and the tubercle of the Ilium, which is 6cms posterior to the ASIS. This is the region ideal for harvesting graft due to the thick cortical plate and enormous cancellous bone making it a graft reservoir. The **inner plate of Ilium** has curvature closely approximating that of orbital floor and thickness, permitting reconstruction of severely collapsed floor or missing inferior orbital margin[55].

Muscle & Ligament Attachments to Anterior Iliac Crest Region:

- Inguinal ligament: It attaches to the ASIS and inserts onto the pubic tubercle.
- Sartorius muscle: It attaches to the ASIS and inserts onto the medial aspect of the tibia. Both these structures should not be encountered during dissection.
- Tensor fascia lata: It originates from the anterior iliac crest laterally it fans out inferiorly to attach to the knee joint - lateral tibia. It is the most important structure related to gait

disturbance, thus limiting dissection to the medial aspect of iliac crest.

- Gluteus medius
- Gluteus minimus
- External abdominal oblique
- Iliacus: Reflected to avoid disruption, as medial to it is the peritoneum.

Cutaneous Nerves in Anterior Iliac Crest Region

- Lateral cutaneous branch of the iliohypogastric nerve (L1, L2) runs over the tubercle of the ilium
- Lateral cutaneous subcostal nerve (T12, L1) runs over the tip of the ASIS & is inferior to the iliohypogastric nerve.
- Lateral femoral cutaneous nerve- courses medially between the Psoas major and Iliacus muscle, deep to the inguinal ligament and innervate the skin of the lateral thigh. In 2.5% cases it courses within 1cm of the ASIS & when injured, it causes 'meralgia paresthetica', persistent dysesthesia and anaesthesia to the lateral thigh.[67]

Blood Supply to AIS

- Perforating branches of the deep circumflex iliac artery and vein, located medial to the medial Ilium.
- Gluteal artery- most common source of bleeding during the harvest of the AIS.

SURGICAL ANATOMY OF MANDIBULAR SYMPHYSIS REGION :(Color Plate III)

The mandible is a tubular long bone bent into a blunt V – shape. The cortical bone is thicker anteriorly & at lower border of mandible, thus it is strongest anteriorly. This V shaped bone is modified by the functional processes – namely, the angles, Coronoid/Condylar processes and alveolar process.

The Symphysis menti or mandibular symphysis is the median fusion of the two halves of the mandible. It is characterized by a centrally placed mental protuberance and laterally placed flattened surfaces making the anatomic variation a donor site that creates grafts with morphologic differences. It is limited laterally by the 2 mental foramina, superiorly by the roots of incisors, canines and 1st bicuspids.

The muscles attached to the symphysis includes Mentalis, Depressor labii inferioris, Depressor anguli oris which are stripped off the bone during harvesting. Care is taken in suturing back the Mentalis muscle to prior position to avoid drooping chin & lifeless appearance of lower lip.

The bone in this region is usually dense with little cancellous bone. Previous studies have reported that average bone volume[2] obtained from symphsis is 4.71 ml and average size of cortico-cancellous block measures 20.9 x 9.9x6.9 mm. The cortical bone has many haversian system making it highly osteoconductive.

REVIEW OF LITERATURE

***Description & diagnosis of orbital blow out fracture*:**

Lang (1889)[27] described the first case of orbital blow out in literature.

Pfeiffer (1943)[51] investigated a series of 120 cases of fracture of facial skeleton involving orbit clinically & radiologically. He observed traumatic enophthalmos in 54 cases .He considered that the condition arose as a result of globe being forced against the thin posterior portion of orbital floor at the point where it slopes upward.

Schelderup (1950)[27] commented upon the fibrosis between the undersurface of globe and the defect in orbital floor as a cause of restriction in vertical rotation.

Smith & Regan (1957)[63] coined the term **"Blow out fracture"** for isolated fracture of orbital floor arising from hydraulic forces secondary to posterior displacement of globe and compression of periorbital fat.

Converse & Smith (1960)[11] introduced the concept of **"pure"** (isolated floor) & **"impure"** (floor & rim) blow out fractures.

Dingman & Natvig (1964)[27] drew attention to a rare phenomenon of elevation of orbital floor fragments with intact orbital rim. They termed this condition as **"blow in fracture".**

Jones & Evans (1967) [27]showed that floor of orbit medial to infraorbital canal & the medial wall are the thinnest averaging 0.27mm.

Mustarde(1968)[45] described role of the suspensory ligament system in preventing globe displacement in particular the Lockwood's ligament.

Deutschburger & Kirschner (1971) [27]observed in 47 cases, the cardinal & guiding factor for determining the need for surgical intervention as the size of the orbital floor defect. A defect more than 1 cm dimension by poly tomography necessitates intervention.

Roncevic &Malinger (1981)[53] advocates open reduction with floor exploration when evidence of prolapse of orbital contents into sinus occurs as in impure fractures associated with Le fort /Zygoma fracture.

Koorneef (1982) [30]agreed with Putterman that restricted motility after orbital blow out is caused by hemorrhage & edema at the site of injury &advocated orbital exercises .

Manson et al (1985)[37] emphasized the role of the displacement of intraconal orbital fat outside the muscle cone as sequel of trauma to contribute to enophthalmos

Tesseir (1986)[27] stressed the need for wide dissection of periorbital tissue around the defect of floor especially in late repair or noted enophthalmos.

Pearl (1987)[27] reported a study of orbital fractures in fresh cadavers & chimpanzees. He found that orbital fracture behind axis of globe, with volumetric displacement & rupture of musculofascial cone, predisposed to enophthalmos.

Parson & Mathog (1988)[27] showed that 1mm of displacement of orbital floor resulted in 0.4 ml increase in orbital volume & 1.5 mm change in globe position.

Noah A Sandler, Richardo L Carrau, Mark W Ocho (1999)[47] evaluated the ability to diagnose orbital floor fracture through transantral endoscopy. They advocate its use in those trauma patients whose concomitant injury may prohibit other diagnostic modalities.

Lawrence Tong, Richard J Baurer, Steven R Buchman (2000)[31]retrospectively studied 199 cases of treated orbital floor

fracture and concluded that impure fracture was caused by high energy trauma & pure fracture by low energy trauma.

Brian Swinson, Mike Amin, Prem nair, Tim Lloyd, Peter Ayliffe (2004)[9] reported a series of 3 cases of isolated bilateral orbital floor fracture.

Strong EB (2004)[64] reported transmaxillary endoscopic repair of orbital blow out fracture. It offers improved visualization, anatomic repair and no risk of post operative eyelid complications and good clinical results.

Xianqun Fan, Huifang Zhou, Ming Lin, Yao Fu, Jin Li, (2007) [70] did a prospective study on 17 patients with complex orbital fractures constructing 3D Images, computer generated models ,Orbital volume calculation using Surfacer software and developed a CAD/CAM system to help improve the surgical planning of complex orbital fracture.

Radiologic evaluation:

Birsch-Hirschfeld (1930)[51] demonstrated that in 91out of 168 cases of traumatic enophthalmos, there was radiological evidence of blow out fracture of orbital walls.

Crikelair & co-workers (1972)[27] demonstrated that orbital floor fracture was over diagnosed by plain films. He promoted surgical treatment in fracture evident in tomogram with persistent diplopia & enophthalmos after 2 weeks.

H**ammerschlag et al (1982)**[51] reported 100% accuracy in diagnosis of orbital blow out fracture of floor using 2mm thick sagittal sections CT scans & lateral Tomogram.

Zonneveld & Koornneef (1986)[27] described a specific position for sagittal CT examination of orbit parallel to optic nerve. High resolution artifact free image are obtained. They also used direct tri plane high resolution CT to demonstrate scar tissue and emphasized that motility disorder occurs with connective tissue disturbance inside orbit and not muscle entrapment.

Tonami et al (1991)[51] compared the value of MRI, CT & plain radiographs. MR was accurate in demonstrating soft tissue &useful in diagnosis of incarceration of orbital fat.

Lee J W (1993)[33] evaluated orbital volume change in blow out fracture using quantitative CT and concluded that a bony volume change of over 8 % implies poor cosmetic outcome indicating need for surgical correction.

Charteis et al (1993)[51] using CT scan demonstrated significant difference of orbital volume between patients treated surgically and conservatively for blow out fracture.

G Ramieri, MC Spada, SD Bianchi and S (2000)[22] The morphology and dimensions of the orbit and of fat content were investigated in 25 patients by image analysis and volumetric estimation from 2D and 3D-CT. Posttraumatic enophthalmos commonly related to failure in correcting the orbital volume and in reducing the outward dislocation of the posterior orbital floor and not to changes in the fat content.

P Angela Rake, Scott A Rake, James Q Swift, Warren Schubert (2004)[48]suggest routinely obtaining a single reformatted oblique sagittal view as an adjunct to coronal CT. It provides additional valuable information in minimal time and requires no additional radiation.

Nicholas A. Drage a, Vaseekaran Sivarajasingam b (2009)[46] described the use of cone beam computed tomography for use in isolated fractures of the orbital floor. This requires lower dose of radiation than conventional computed tomography.

Timing of the surgery:

Dulley & Fells (1975)[27] observed from their study on 103 patients, that there was 72 % incidence of enophthalmos in patients treated 6 months or later after injury, in comparison to 20% in patients treated within 14 days of trauma.

Hawes & Dortzbach (1983)[51] stressed the importance of surgical repair within two weeks of injury for fracture involving more than half of the floor ,with persistent diplopia within 30 degree of primary gaze.

Iro.H (1989)[26] retrospectively analyzed 65 floor fractures and recommended early operative treatment in view of poor results with non operative therapy.

Lenzyel D, Breyer A, Mojol Ds (2003)[34] reported a series of 12 operated blow out cases and suggest surgical reconstruction within the first week after trauma for good results.

Damir B. Matic, Raymond Tse, Avik Banerjee, Cory C. Moore (2007)[13]A four-year institutional review in patients with orbital floor fractures treated non-operatively. They observed that a height-to-width ratio of the inferior rectus muscle on coronal CT scan of greater than or equal to 1.00 is predictive of late enophthalmos.

Simon (2010)[61] reported that post-operative outcomes were similar between patients with orbital floor fractures who had early repair & those with late repair.

Surgical Approaches To Orbital Floor:

Transcutaneous:

Converse (1944)[16] popularized the Subciliary incision, where the skin was incised several millimeters below lid margin in a skin crease.

Weckler (1984)[69] used the skin- muscle eyelid flap in Subciliary incision and found aesthetically acceptable scar.

McCollough (1988)[42] viewed against the classic lower lid incision and suggested lower lid incision along the inferior border of tarsus.

Antonyshyn (1989)[4] found 16.6% occurrence of ectropion and scleral show deformity following Subciliary approach.

Transconjunctival approach:

Bourquett(1924)[10] first described the Transconjunctival approach as a method for lower Blepharoplasty.

McCord and Moses (1970) [51] popularized the technique along with lateral cantholysis (swinging lower eyelid flap) that suited adequate exposure of orbital floor.

Tessier and Converse (1973) [51]popularized Transconjunctival approach for correction of congenital deformity involving orbit.

Baumann & Ewers (2001) [6] stated that preseptal Transconjunctival approach as preferred approach than retroseptal due to minimal disturbance of intra orbital connective tissue framework.

***Various Reconstructive options*:**

Kaye (1966)[27] suggested use of bone from **anterior wall of antrum** as a graft for orbital floor reconstruction using Caldwell-Luc approach.

Hotte (1970)[27] prefers to use a plate of cancellous bone from **contra lateral mastoid** for orbital floor reconstruction.

Metin Gungormus & M.Selim Yavuz(2002)[43] did a quantitative study on amount of bone graft present in **anterior part** of the **Mandibular ramus** for reconstruction of fracture of the orbital floor, emphasized that the contour of this donor site approximated the bony structure of the orbital floor and rim.

Rowe (1985)[27] suggested autogenous bone when restoring defect more than 1.5 cm in diameter as often there is insufficient bone margin on which alloplast can rest.

Sargent LA, Fulks KP (1991)[56] reported reconstruction of internal orbital fracture with Vitallium mesh.

Iizuke et al (1991)[25] reported use of **Polydioxanone** which proved satisfactory but its resorption made it difficult to predict & compensate for the drop in level of globe.

Rubin et al (1992)[27] suggested the use of soft **titanium mesh** to support large bone grafts to restore orbital volume to normal.

Hayasaka, Aikawa, Wada, Kodama, Noda (1994)[23] reported transconjunctival & trans antral approaches combined with antral wall bone graft to repair orbital floor blow out fracture for 2 patients.

Leon A Assal & David M Feinerma (1994)[35] used a solitary lag screw technique for securing orbital bone grafts- Calvarial & Maxillary antral bone grafts to intact infra orbital rim. It is quick, safe, and stable.

Rowe (1994)[27] prefers to harvest bone from **inner plate of Ilium** where curvature closely approximates to that of orbital floor and thickness permits reconstruction of severely collapsed floor or missing inferior orbital margin.

Archie.D.Morrison, Christofer Sanderson & Khursheed F Moos (1995)[5] retrospectively reviewed 311 cases of orbital floor & walls secondary to trauma treated by **Silastic implants**. 13% of patients had it removed for reasons of infection, implant migration & worsening eye signs like diplopia.

Fabian WC Ordewener, Fred R Rozema, Houtman (1996)[19] used **Poly l-Lactide** implants for repair of orbital floor defects in 6 patients & evaluated using MRI. They concluded that PLLA implants have potential for successful use in orbital floor repair.

Bahattin Celikoz,Haluk Duman (1997)[7] reviewed the results of using **lyophilized tensor fascia lata** for the repair of orbit floor defects in 12 patients. It is easy to shape and place in the defect suitable for repair of small to moderate sized orbital floor defects.

Vijayan Krishnan & James V Johnson (1997)[68] retrospectively studied 16 patients with isolated blow out or floor defect reconstructed with **mandibular symphysis bone graft**. Symphysis bone grafts were used when the defects were less than 2 cm in

diameter. The mandibular symphysis is readily available source of autogenous bone that can be harvested with minimal morbidity. Its contour is suitable for reconstruction. It merits consideration when autogenous bone grafts are required for floor defects less than 2 cm in diameter.

Sheldon M Mintz, Anna Ettinger, Timothy Schmaken (1998)[57] in their study compares the contour of the **Coronoid process** with the orbital floor using skulls & showed the use of this bone as a graft in orbital floor reconstruction. Based on the anatomic studies and clinical results the Coronoid process makes an excellent donor graft site for orbital floor reconstruction.

Jurgen Hoffmann, Carl Peter Cornelius (1998)[29] reported reconstruction of orbit with individually copy milled ceramic implants. They designed ceramic implants (BIOVERT) on the basis of Stereolithiographic models. Pre fabrication of the required implant reduced operating time and patient morbidity significantly.

Lai A, Glicklich RE, Rubin PA (1998)[32] reported 13 patients with orbital blow out fracture treated by Nasoseptal cartilage. They concluded that **Nasoseptal cartilage** is an easily accessible, abundant autogenous graft that provides support to the orbital floor.

Peter E Johnson & Ionno Rafto Poulos (1998)[50] described a technique for in situ splitting of a **rib graft** for orbital floor reconstruction.

Andre montazem (2000)[2] in his quantitative study in 16 cadaver mandibles stated that the average bone volume available from mandibular symphysis is 4.84ml and 4.71 ml by 2 different (displacement volumetry) methods.

Mario F Muoz Guerna, Jesus Sastre Perz, Franscisco J Rodriguez (2000)[38] reported use of **Dehydrated human duramater** when disruption was less than 2 cm diameter. A 7% complication rate was noted.

Andrea Castellani, Stefano Negrini & Umberto Zanetti (2002)[3] used **conchal auricular graft** in 14 cases. It provides an optimal support for the globe, minimal donor site morbidity, easy to harvest and adequate stability.

Shoab A Siddique, Robert H Mathog (2002)[58] evaluated the results of cranial (membranous) Vs iliac crest (endochondral) bone graft as implants to correct post traumatic globe malposition and / or diplopia in 22 patients. They found both to be equally efficacious.

Pedro M Villarreal, Florencio Monje, Antonio J Morillo (2002)[49] evaluated the use of porous poly ethylene ultra thin sheets for orbital floor reconstruction in 32 patients. They reported good long term success with poly ethylene sheets.

Gellrichet al(2002)[21] have used surgical navigation systems for computer-assisted preoperative planning and intra operative control in the reconstruction of orbital deformities. CASS can plan bone graft positions and orbital frame contours before surgery to recover the appropriate OV. However, CASS requires expensive instrumentation.

Edward Ellis, Yinghu Tan (2003)[17] retrospectively assessed the adequacy of internal orbital reconstruction in blow out fracture using either cranial bone graft or titanium mesh implants, in 58 patients. Orbits reconstructed with titanium mesh showed better results, though both are successful.

Masaaki Kosaka, Yusuke Matsuzawa, Hiromase Mori Kazuhide, Matsunga (2004)[40] made a study to assess the efficacy of bone grafting from mandibular outer cortex for orbital wall reconstruction. Grafts were taken from a) Mental region b) Area posterior to mental foramen c) Ramus region. They concluded that shape of the mandibular surface exhibits various curvatures. These variations may be applicable to the orbital walls which are

themselves characterized by various curvatures. They suggest mandibular outer cortex as the first choice of the graft material in orbital floor reconstruction.

Christopher P. Kelly, Adam J. Cohen, Reha Yavuzer, Ian T. JacksonChristopher P. Kelly, Adam J. Cohen, Reha Yavuzer, Ian T. Jackson study, (2005)[12] compared exogenous materials and autogenous bone for orbital reconstruction. The study indicates that cranial bone grafting for reconstruction of the orbit remains the material of choice.

Risto K. Kontio, ,Pekka Laine,Antero Salo,Pertti Paukku, Christian Lindqvist,.Riitta Suuronen, (2006)[55] did a prospective study to clinically and radiologically assess the outcome of internal orbital reconstruction with an iliac bone graft. They concluded that the resorption rate was high, but most of it was advantageous remodeling. Thin computed tomography and magnetic resonance imaging sections (2 mm) are needed to evaluate accurately bone graft placement and posture and orbital volume.

Yukiko Nishi, Kensuke Kiyokawa, Koichi Watanabe, Hideaki Rikimaru, Toshihiko Yamauchi, (2006)[72] conducted study based on the method reported by Matsuo (1989) & showed sliced costal cartilage chip grafts were be an effective method for the treatment of late posttraumatic enophthalmos.

Matti Peltola, Ilpo Kinnunen, and Kalle Aitasalo, **(2008)**[41] retrospective series of 49 patients showed BAG plate to be a well-tolerated, reliable reconstruction material; but being brittle and rigid they cannot be molded and shaped by a surgeon.

Tadeusz Cievlik, Jacek Skowronek, Magdalena Cievlik, and Agata Cievlik-Bielecka, (2009)[66]analyzed the use of anterior maxillary wall bone graft for floor fracture in 18 patients. Shortening of surgery time and limitation of operative procedures are advantages of this method.

Shunsuke Sakakibara, Kazunobu Hashikawa, Hiroto terashi, Shinya Tahara(2009)[60]used 1mm thinned & trimmed iliac cancellous bone sheets in 101 patients and concluded that the beamed structure of iliac medulla gives robustness to graft yet pliable to to fit the gently curving orbital floor.

Mohammad Bayat, Fatemeh Momen-Heravi ,Omid Khalilzadeh, Zeeia Mirhosseni, Ali Sadeghi-Tari (2009)[44] think that **nasal septal cartilage** is a better graft than Conchal cartilage for reconstruction of blowout fractures.

Xu Jia-jie, Teng Li, Jin Xiao-lei, Ji Ying, Lu Jian-jian, and Zhang Bo, (2009)[71] in a study on 68 patients showed Porous polyethylene sheet implant as a very reliable material for

reconstruction for the orbital blow-out fractures and restoration of the orbital volume. But Overcorrection of 1 to 2 mm is necessary to neutralize the tissue swelling or atrophy.

Shinichi Asamura, Yoshito Ikada, Kazuhide Matsunaga, Mitsuhiro Wada, Noritaka Isogai (2010)[59] performed a study on bone regeneration using a Periosteum polymer complex (Periosteum + Hydroxyapatite sheet+ iliac graft)&found not more than 2 mm of enophthalmos in any patient.

Simon J.B.Prowse, Phoebe M.Hold, RobertF. Gilmour, UpasnaPratap, Eldon Mah, FrankW.Kimble (2010)[61] evaluated the long- term(12 years) outcomes of orbital floor reconstructions with silicone versus non-silicone implants(titanium mesh, 'Lacta-sorb', autologous grafts) &found good results with silicone implants, contrary to much of the literature.

MATERIAL AND METHODS

The study includes 8 cases (two groups) of orbital blow out fracture with associated Zygomatico-maxillary complex fracture, who reported to the department of Oral and Maxillofacial Surgery, TNGDC. We treated the orbital floor defects in group I using mandibular symphysis graft (4 cases) and group II using iliac cortical graft (4 cases).

The criteria for selection of patients includes,

Inclusion Criteria:

- Enophthalmos
- Hypoglobus
- Diplopia
- Radiological evidence of orbital content herniation in floor defect
- Mechanical restriction in ocular motility (Forced Duction Test +)

Exclusion criteria:

- Medically compromised patients
- Patients with generalised bony disorders
- H/O mandible #(group I) ,pelvic bone #(group II)
- Optic neuropathy/post trauma blindness
- Only seeing eye
- Globe perforation/retinal detachment

All eight patients were male patients in age range of 21 to 40 years. All cases except for three were treated within 6 weeks of trauma. The 3 cases included two post traumatic secondary deformities (2 years old) and 1 case was 3 months old deformity.

Preoperative assessment of the patients was done. CT scan imaging was done for all patients using ***GE Discovery VCT Workstation 4.4***.The area of defect was measured in cm^2. The volumetric assessment of the orbit was done with the aid of ***Volume viewer*** (an installed application) using 0.625 mm sections and measured in cubic centimeter (cm^3).Patients with defect of area less than 2 cm^2 and orbital volume expansion of less than 4.7 cm^3 were included under group I. The remaining cases with defect greater than 2 cm^2 and volume expansion more than 4.7cm^3 were included under group II[2].

All the cases were treated similarly via infraorbital approach / pre existing scar (if feasible). The associated maxillofacial injuries were treated appropriately. One case (case -2) had a scar & contracture of upper eyelid with notching deformity, treated by scar revision done by surgical team from Department of plastic surgery, GGH.

Routine informed consent was obtained from all patients as a part of surgical protocol. All cases were operated under general

anesthesia with nasal / Oro Endotracheal intubation in GGH, Chennai.

***Pre-Operative Assessment*:**

Evaluation of the patient included a thorough and detailed history, clinical examination including general examination & ophthalmologic examination, facial photographs and radiographic examination.

HISTORY:

Included Chief complaints, history of present illness, previous surgical and medical history.

CLINICAL EXAMINATION:

***Ophthalmologic Examination*: All 8 patients underwent an ophthalmologic examination** at Government regional Institute of Ophthalmology, Egmore.

PARAMETERS	**RIGHT EYE**	**LEFT EYE**
VISUAL ACUITY		
EYE LIDS		
OCULAR MOVEMENT		
CONJUNCTIVA		
CORNEA		
IRIS		
ANTERIOR CHAMBER		

PUPILS		
LENS		
Hertel EXOPHTHALMOMETRY (if applicable)		
FIELD		
FUNDUS		
FORCED DUCTION TEST		

DIPLOPIA CHART:

OCULAR MOVEMENTS:

Extent & quality—

Maintenance of fixation—

Position of eyelids &globe—

PERIORBITAL EXAMINATION:

Intercanthal distance=

Canthal plane-

Intra Oral Examination;(Group I)

A detailed assessment of mandibular 6 anterior teeth were made including test of Vitality(using EPT), mobility, periodontal pocket, gingival recession, dental caries or restoration.

RADIOLOGIC EXAMINATION:

- X ray view – Water's projection

  Profile Teleradiography -Lateral Skull (Group I)

  IOPA of lower 6 anterior teeth (Group I)

  Orthopantomographs

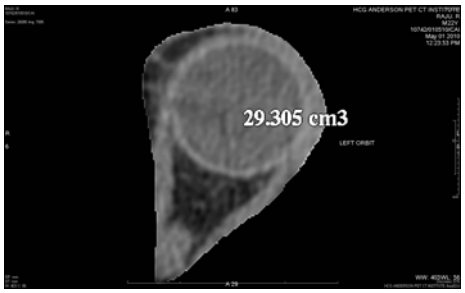
  Pelvis PA view (Group II)

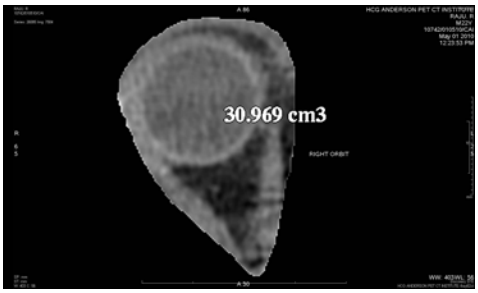
- CT scan – Coronal, Sagittal, Axial views

  3D reformatted image

  Area of defect assessment

  Orbital volume assessment





SURGICAL TECHNIQUE

SURGICAL TECHNIQUE OF MANDIBULAR SYMPHYSIS BONE GRAFT HARVESTING(Group I)-Color Plate IV

A Vasoconstrictor (Adrenaline with saline in a concentration of 1in 1,00,000) is injected submucosally in the labial vestibule, area of incision to reduce bleeding. A vestibular incision is made 5 mm below the keratinized mucosa limit from the first premolar on one side to that of the opposite side premolar. The blade was angled at 45 degree to incise the mentalis and periosteum. The chin was degloved using a periosteal elevator and when approaching the inferior border the muscle insertions are sharply detached. A lower border retractor was placed. To proceed safely to the donor area the **"5s"** rule should be followed, staying 5 mm away from root apices, mental foramina and inferior border of mandible[20]. After estimating the root length of both sides canine, the graft was outlined using a 702 fissure bur below the apices of incisors and canine leaving the base of the mandible intact (technique proposed by Sindet-Pederson)[62]. Fine osteotome is used to elevate the cortical graft from the chin. The harvested bone was preserved in saline soaked damp gauze. Hemostasis was achieved using bone wax over the decorticated site. Layerwise closure of Mentalis muscle and mucosa was done with 3-0 vicryl. A pressure dressing was placed in the chin for 24 hrs.

SURGICAL TECHNIQUE OF ANTERIOR ILIAC CREST CORTICAL GRAFT HARVESTING (Group II)-Color Plate V

The hip is elevated with a sand bag to better expose the iliac crest. Preparation and draping are performed, with the superior iliac spine and the iliac crest centered within the surgical field. The incision to approach the anterior iliac crest was marked when the skin overlying the anterior iliac spine is retracted medially, which facilitates the post-operative scar to be lateral to the iliac crest. A 4 -6 cm incision was placed 1-2cms posterior to the ASIS, obliquely along the orientation of the anterior iliac crest. This avoids the course of the Iliohypogastric and Subcostal nerves superiorly and the lateral femoral cutaneous nerve inferomedially. The layers encountered are skin, subcutaneous tissue and Scarpa's fascia down to the periosteum. It is ideal to follow this hypovascular plane without dissecting the muscles, thereby avoiding post operative pain and gait disturbance[66]

Once the periosteum was sharply incised, a subperiosteal dissection was done with extension to the medial surface to expose the superior iliac crest and the iliac fossa. Care is taken not to penetrate medially to avoid injury to the underlying bowel and entry into the peritoneal cavity.

The "splitting technique" was used[20]. Once exposed, the total bone length of 4-6cms can be osteotomised and is limited by the

proximity to the anterior iliac spine and tubercle of Ilium. An anterior osteotomy cut was given 1cm posterior to anterior iliac spine and the posterior osteotomy cut 1cm anterior to the tubercle. This limits the risk of fracture to anterior iliac spine and tubercle of Ilium. A connecting osteotomy cut was given and a small curved osteotome is used to remove the desired shape of unicortical ilium of any size or shape.

SURGICAL TECHNIQUE OF ORBITAL FLOOR RECONSTRUCTION (Color Plate VI)

Step-1: Preparation of the surgical site:

The orbital floor was approached through an infraorbital or subtarsal approach or through existing scar, when applicable in all the 8 cases.

Step-2: Marking the incision:

Temporary tarsorraphy was done with 4- 0 silk. The infraorbital incision was marked along the inferior margin of lower tarsus in skin crease or in existing scar with marking ink. The length of the incision was planned in relation to size of the defect.

Step -3: Infiltration of vasoconstrictor:

A Vasoconstrictor (Adrenaline with saline in a concentration of 1in 1,00,000) injected subcutaneously in the area of incision to reduce bleeding.

Step-4: Skin incision and dissection to periosteum:

The incision was given with No.15 blade. Dissection was done through the skin, subcutaneous tissues and the skin was dissected from Orbicularis Oculi muscle for a few millimeters before splitting the muscle down to orbital septum. The infraorbital nerve was then identified and retracted downwards. The muscle fibers were retracted to expose the periosteum.

Step-5: Exposure of the orbital floor defect:

The periosteum is incised 5-7 mm from infraorbital rim to avoid the orbital septum and the orbital fat. Subperiosteal dissection is done along the floor within safe limits as proposed by Rontal (1979)[27]. The orbital floor is explored .Any orbital musculofascial entrapment and herniation relieved. The defect is measured.

Step-6: Reduction and fixation of associated fractures:

In patients with associated Zygomaticomaxillary complex fracture ,the fractures were reduced via Dingman approach and fixed with miniplate and screws appropriately.

Step-7: Adaptation of the graft & placement:

The harvested graft is customized to the size and shape of the defect taking care that the graft is designed with the periosteal surface facing the globe. Minor contouring was done for exact fit and stable bone on either side of defect was engaged for stabilizing graft in position. Care was taken to eliminate any sharp edges on the graft.

Step-8: Closure:

Hemostasis was achieved. A forced duction test was done to ensure passive movement of eyeball with no mechanical restriction .Graft stability checked and periosteal closure done to achieve tight closure. This was accomplished with interrupted absorbable sutures (3-0 vicryl) , and skin with nonabsorable suture material (5-0 Prolene) subcuticular sutures. Dressing was placed &Tarsorraphy released.

POST OPERATIVE CARE

After extubation, patients were shifted to the postoperative ward and administered antibiotics, anti-inflammatory and analgesic regime for a period of 1week.Nasal decongestant and antibiotic eye drops were given for 5 days.

The patient was allowed to ambulate on the 2nd postoperative day with assistance initially, if needed. Drain if placed was removed after 48 hours. Physiotherapy for the operated lower limb was commenced 7 days post operatively and continued for 4 weeks. The suture removal was done between the 5^{th}-10^{th} post operative day. All patients were maintained on a soft diet for the first 2 weeks postoperatively.

Follow up:

All the patients were asked to report to the out patient department for clinical, ophthalmologic and radiographic assessment once in a month. Waters projection of skull was done in first month, followed by CT scan and orbital volume assessment, graft density measurement at 3^{rd} post operative month. The follow up period ranges from minimum of 3 month to maximum of 6 months.

CASE REPORT -1

NAME: Mr . Ritesh Raju **AGE /SEX:** 21 years/ male

CHIEF COMPLAINT: Patient complains of pain in right eye region, inwardly placed eye, with numbness over the area beneath right eye for past 3 weeks.

HISTORY OF PRESENTING ILLNESS: History of alleged RTA – two wheeler Vs two wheeler, with his right side face hitting the ground,3 weeks back. No history of altered vision or double vision.

PAST MEDICAL /SURGICAL HISTORY: Not relevant

GENERAL EXAMINATION: Patient is moderately built & well nourished.

OPHTHALMOLOGIC EXAMINATION:

PARAMETERS	RIGHT EYE	LEFT EYE
VISUAL ACUITY	6/6	6/6
EYE LIDS	Normal	Normal
OCULAR MOVEMENT	Full	Full
CONJUNCTIVA	Clear	Clear
CORNEA	Clear	Clear
PUPILS	3mm RTL	3mm RTL
LENS	Clear	Clear
EXOPHTHALMOMETRY	18mm	16mm
FUNDUS EXAMINATION	Normal	Normal
FORCED DUCTION TEST	NA	NA
INFRA ORBITAL SENSATION	Diminished	Intact

DIPLOPIA CHART: Negative

OCULAR MOVEMENTS: Full

POSITION OF EYELIDS &GLOBE—Right eye hypoglobus, enophthalmos and Deep supra tarsal crease

PERIORBITAL EXAMINATION:

Right eye : The patient had periorbital edema and ecchymosis. There were multiple scars medial and inferior to lower lid. On palpation, step deformity was felt in the right infraorbital rim.

INTRAORAL EXAMINATION: Occlusion was normal.

Donor site – No abnormality detected

RADIOLOGICAL INVESTIGATIONS:

- **PNS** shows disruption of right orbital floor and infra orbital rim.
- **Scan with 3-D reconstruction** showed similar findings.

	Orbital Volume(cm^3)
Right orbit	30.509 cm^3
Left Orbit	29.517cm^3

- Defect = 1.2cm^2

DIAGNOSIS: Right orbit-Impure blow out # of floor & infra orbital rim.

TREATMENT PLAN: Right Orbit floor reconstruction with mandible symphysis graft.

CASE REPORT – 2

NAME: Mr . Vimal **AGE /SEX:** 21 years/ male

CHIEF COMPLAINT: Patient complains of pain in left eye region, inwardly placed eye, with numbness over the area beneath left eye for past 35 days.

HISTORY OF PRESENTING ILLNESS: History of fall from a tree 35 days back with the left side of face hitting the ground. No history of altered vision or double vision.

PAST MEDICAL /SURGICAL HISTORY: Not relevant

GENERAL EXAMINATION: Patient is well built & well nourished.

OPHTHALMOLOGIC EXAMINATION:

PARAMETERS	**RIGHT EYE**	**LEFT EYE**
VISUAL ACUITY	6/6	6/6
EYE LIDS	Normal	Scar/notch defect
OCULAR MOVEMENT	Full	Full
CONJUNCTIVA	Clear	Clear
CORNEA	Clear	Clear
PUPILS	3mm RTL	3mm RTL
LENS	Clear	Clear
FUNDUS EXAMINATION	Normal	Normal
FORCED DUCTION TEST	NA	NA
INFRA ORBITAL SENSATION	Intact	Diminished

DIPLOPIA CHART: Negative

OCULAR MOVEMENTS: Full

POSITION OF EYELIDS &GLOBE-Left eye enophthalmos, upper eyelid had a scar with notching defect, Deep supra tarsal fold

PERIORBITAL EXAMINATION:

Left eye: The patient had mild periorbital edema and tenderness. There was scar with contracture causing notching defect of upper eyelid margin, thus incomplete closure. On palpation, step deformity was felt in the infraorbital rim.

INTRAORAL EXAMINATION: Occlusion was normal.

Donor site – No abnormality detected

RADIOLOGICAL INVESTIGATIONS:

- **PNS** shows disruption of right orbital floor and infra orbital rim.
- **Scan with 3-D reconstruction** showed similar findings.

	Orbital volume(Cm^3)
Right orbit	20.015
Left Orbit	23.883

- Defect area =1.6cm^2

DIAGNOSIS:

Left orbit-Impure blow out # of floor,

Left upper eyelid notching deformity with scar contracture

TREATMENT PLAN:

Orbital floor reconstruction with mandible symphysis graft and scar revision

CASE REPORT – 3

NAME: Mr.Anbarasu **AGE /SEX:** 23 years/ male

CHIEF COMPLAINT: Patient complains of pain in right eye region, inwardly placed eye, for past 3 weeks.

HISTORY OF PRESENTING ILLNESS: History of alleged RTA – two wheeler Vs two wheeler, with his right side face hitting the ground. No history of altered vision or double vision.

PAST MEDICAL /SURGICAL HISTORY: Not relevant

GENERAL EXAMINATION: Patient is moderately built & nourished.

OPHTHALMOLOGIC EXAMINATION:

PARAMETERS	**RIGHT EYE**	**LEFT EYE**
VISUAL ACUITY	6/6	6/6
EYE LIDS	Normal	Normal
OCULAR MOVEMENT	Full	Full
CONJUNCTIVA	Temporal SCH	Clear
CORNEA	Clear	Clear
PUPILS	5mm RTL	3mm RTL
LENS	Clear	Clear
FUNDUS EXAMINATION	Normal	Normal
FORCED DUCTION TEST	NA	NA
INFRA ORBITAL SENSATION	Intact	Intact

DIPLOPIA CHART: Negative

OCULAR MOVEMENTS: Full

POSITION OF EYELIDS &GLOBE—Right eye enophthalmos

Deep supra tarsal sulcus

PERIORBITAL EXAMINATION:

Right eye:

The patient had periorbital edema and ecchymosis with subconjunctival haemorrhage. On palpation, step deformity was felt in the infraorbital rim and lateral wall.

INTRAORAL EXAMINATION: Occlusion was normal.

Donor site – No abnormality detected

RADIOLOGICAL INVESTIGATIONS:

- **PNS** shows disruption of right orbital floor, infra orbital rim &lateral orbital wall.
- **Scan with 3-D reconstruction** showed similar findings.

	Orbital volume(Cm^3)
Right orbit	24.333
Left Orbit	22.462

- Defect =1.24 cm^2

DIAGNOSIS:

Right orbit-Impure blow out # of floor

Right zygomaticomaxillary complex #.

TREATMENT PLAN:

Orbital floor reconstruction with mandible symphysis graft and Open reduction & internal fixation of the associated ZMC #.

CASE REPORT 4

NAME: Mr.Sakthivel **AGE /SEX:** 28 years/ male

CHIEF COMPLAINT: Patient complains of pain in right eye region, inwardly placed eye, with numbness over the area beneath right eye for past 3 weeks.

HISTORY OF PRESENTING ILLNESS: History of alleged RTA – two wheeler Vs two wheeler, with his right side face hitting the ground. No history of altered vision or double vision.

PAST MEDICAL/ SURGICAL HISTORY: Not relevant

GENERAL EXAMINATION: Patient is moderately built & nourished.

OPHTHALMOLOGIC EXAMINATION:

PARAMETERS	**RIGHT EYE**	**LEFT EYE**
VISUAL ACUITY	6/6	6/6
EYE LIDS	Normal	Normal
OCULAR MOVEMENT	Full	Full
CONJUNCTIVA	Clear	Clear
CORNEA	Clear	Clear
PUPILS	5mm RTL	3mm RTL
LENS	Clear	Clear
FUNDUS	Normal	Normal
FORCED DUCTION TEST	NA	NA
INFRA ORBITAL SENSATION	Diminished	Intact

DIPLOPIA CHART: Negative

OCULAR MOVEMENTS: Full

POSITION OF EYELIDS &GLOBE—Right eye enophthalmos

Deep supra tarsal fold

PERIORBITAL EXAMINATION:

Right eye: The patient had periorbital edema and ecchymosis. On palpation, step deformity was felt in the infraorbital rim & lateral orbital rim.

INTRAORAL EXAMINATION: Occlusion was normal.

Donor site – No abnormality detected

RADIOLOGICAL INVESTIGATIONS:

- **PNS** shows disruption of right orbital floor, lateral wall & infra orbital rim.
- **Scan with 3-D reconstruction** showed similar findings.

	Orbital Volume(cm^3)
Right orbit	21.472
Left Orbit	20.348

- Defect =1.8cm^2

DIAGNOSIS:

Right orbit-Impure blow out # of floor.

Right zygomaticomaxillary complex #.

TREATMENT PLAN: Orbital floor reconstruction with mandible symphysis graft and Open reduction & internal fixation of the associated ZMC #.

CASE REPORT -5

NAME: Mr.Santhosh **AGE /SEX:** 23 years/ male

CHIEF COMPLAINT: Patient complains of pain in left eye region, inwardly placed eye, with numbness over the area beneath left eye for past 3 weeks.

HISTORY OF PRESENTING ILLNESS: History of alleged RTA – two wheeler Vs two wheeler, with his left side face hitting the petrol tank. He complains of double vision when looking up, down and towards left for past 3 weeks.

PAST MEDICAL /SURGICAL HISTORY: Not relevant

GENERAL EXAMINATION: Patient is moderately built & nourished.

OPHTHALMOLOGIC EXAMINATION:

PARAMETERS	**RIGHT EYE**	**LEFT EYE**
VISUAL ACUITY	6/6	6/6
EYE LIDS	Normal	Normal
OCULAR MOVEMENT	Full	Restricted elevation
CONJUNCTIVA	Clear	Clear
CORNEA	Clear	Clear
PUPILS	3mm RTL	5mm RTL
LENS	Clear	Clear
FUNDUS	Normal	Normal
FORCED DUCTION TEST	NA	Positive for elevation
INFRA ORBITAL SENSATION	Intact	Diminished

DIPLOPIA CHART RESULTS: Maximum separation of images in superolateral & lateral gaze

OCULAR MOVEMENTS: restricted elevation of left eye

POSITION OF EYELIDS &GLOBE—Left eye hypoglobus, enophthalmos and Deep supra tarsal fold

PERIORBITAL EXAMINATION: The patient had periorbital edema .On palpation, step deformity was felt in the left lateral & infraorbital rim.

INTRAORAL EXAMINATION: Occlusion was normal.

DONOR SITE – No abnormality detected

RADIOLOGICAL INVESTIGATIONS:

- **PNS** shows disruption of left orbital floor, lateral rim & infra orbital rim.
- **Scan with 3-D reconstruction** showed similar findings

	Orbital Volume(cm^3)
Right orbit	25.098
Left Orbit	30.103

- Defect=2.8cm^2

DIAGNOSIS:

Left orbit-Impure blow out # of floor

Left zygomaticomaxillary complex #.

TREATMENT PLAN:

Orbital floor reconstruction with iliac cortical graft & Open reduction & internal fixation of the associated ZMC #.

CASE REPORT – 6

NAME: Mr.Raja **AGE /SEX:** 28 years/ male

CHIEF COMPLAINT: Patient complains of occasional pain in right eye region, inwardly placed eye and double vision for past 2 years.

HISTORY OF PRESENTING ILLNESS: History of alleged RTA- high speed collision of two wheelers, 2 years back. History of treatment in chengalpat GGH, with no improvement in complaints. He complains of double vision when looking up, down and towards sides since trauma .

PAST MEDICAL /SURGICAL HISTORY: Not relevant

GENERAL EXAMINATION: Patient is moderately built & nourished.

OPHTHALMOLOGIC EXAMINATION:

PARAMETERS	**RIGHT EYE**	**LEFT EYE**
VISUAL ACUITY	6/6	6/6
EYE LIDS	Normal	Normal
OCULAR MOVEMENT	Restricted elevation	Full
CONJUNCTIVA	Clear	Clear
CORNEA	Clear	Clear
IRIS	CPN	CPN
PUPILS	3mm RTL	3mm RTL
LENS	Clear	Clear
EXOPHTHALMOMETRY	18mm	14mm
FUNDUS EXAMINATION	Normal	Normal
FORCED DUCTION TEST	Positive for elevation	NA
INFRA ORBITAL SENSATION	Intact	Intact

DIPLOPIA CHART results: Maximum separation of images in superolateral & lateral gaze

OCULAR MOVEMENTS: Restricted elevation of right eye

POSITION OF EYELIDS &GLOBE- Right eye hypoglobus, enophthalmos, & Deep supra tarsal fold

PERIORBITAL EXAMINATION:

There was flattening of right malar prominence and depressed infraorbital rim.

INTRAORAL EXAMINATION: Occlusion was normal.

Donor site – No abnormality detected

RADIOLOGICAL INVESTIGATIONS:

- **PNS** shows lower level of right orbital floor and infra orbital rim.
- **Scan with 3-D reconstruction** showed similar findings

	Orbital Volume(cm^3)
Right orbit	31.852
Left Orbit	28.438

- Defect =2.6 cm^2,

DIAGNOSIS: Right orbit- post trauma deformity of floor with enophthalmos Right malar/infraorbital rim defect

TREATMENT PLAN:

Right malar/infraorbital rim augmentation **& o**rbital floor reconstruction with Iliac cortical graft .

CASE REPORT-7

NAME: Mr.Velmurugan **AGE /SEX:** 38 years/ male

CHIEF COMPLAINT: Patient complains of inwardly placed right eye for past 2 years.

HISTORY OF PRESENTING ILLNESS: History of alleged RTA –two wheeler Vs two wheeler, with his right side face hitting the bike's petrol tank. No history of altered vision or double vision. History of undergoing conservative treatment for frontal bone # &cerebral contusion at GGH, Chennai.

PAST MEDICAL /SURGICAL HISTORY: Not relevant

GENERAL EXAMINATION: Patient is well built & nourished.

OPHTHALMOLOGIC EXAMINATION:

PARAMETERS	**RIGHT EYE**	**LEFT EYE**
VISUAL ACUITY	6/6	6/6
EYE LIDS	Normal	Normal
OCULAR MOVEMENT	Full	Full
CONJUNCTIVA	Clear	Clear
CORNEA	Clear	Clear
PUPILS	3mm RTL	3mm RTL
LENS	Clear	Clear
EXOPHTHALMOMETRY	18mm	13mm
FUNDUS EXAMINATION	Normal	Normal
FORCED DUCTION TEST	NA	NA
INFRA ORBITAL SENSATION	Intact	Intact

DIPLOPIA CHART: Negative

OCULAR MOVEMENTS: Full

POSITION OF EYELIDS &GLOBE-Right eye hypoglobus, enophthalmos, dystopia Deep supra tarsal fold

PERIORBITAL EXAMINATION: There was single scar in forehead and obvious enophthalmos of right eye.

INTRAORAL EXAMINATION: Occlusion was normal.

Donor site examination – No abnormality detected

RADIOLOGICAL INVESTIGATIONS:

- **PNS** shows lower level of right orbital floor and infra orbital rim.
- **Scan with 3-D reconstruction** showed similar findings

	Orbital Volume(cm^3)
Right orbit	34.320
Left Orbit	29.395

- Defect =2.8cm^2

DIAGNOSIS:

Right orbital floor and infraorbital rim deformity with enophthalmos

TREATMENT PLAN:

Orbital floor reconstruction with Iliac cortical graft .

CASE SHEET -8

NAME: Mr.Richard **AGE /SEX:** 21 years/ male

CHIEF COMPLAINT: Patient complains of pain in right eye region, inwardly placed eye, with numbness over the area beneath right eye for past 3 months.

HISTORY OF PRESENTING ILLNESS: History of fall from a fast moving train with the right side of face hitting the ground . History of double vision in extreme gaze. History of undergoing conservative treatment for frontal lobe contusion and frontal bone fracture in Neurosurgery, GGH.

PAST MEDICAL /SURGICAL HISTORY: Patient is on tab.Eptoin 100 mg b.d since the trauma

GENERAL EXAMINATION: Patient is poorly built & nourished.

OPHTHALMOLOGIC EXAMINATION:

PARAMETERS	**RIGHT EYE**	**LEFT EYE**
VISUAL ACUITY	6/6	6/6
EYE LIDS	Normal	Normal
OCULAR MOVEMENT	Full	Full
CONJUNCTIVA	Clear	Clear
CORNEA	Clear	Clear
PUPILS	3mm RTL	3mm RTL
LENS	Clear	Clear
FUNDUS EXAMINATION	Normal	Normal
FORCED DUCTION TEST	NA	NA
INFRA ORBITAL SENSATION	Diminished	Intact

DIPLOPIA CHART: Maximum separation of images in extreme superior gaze

OCULAR MOVEMENTS: Full

POSITION OF EYELIDS &GLOBE-Right eye hypoglobus, enophthalmos, Deep supra tarsal fold. Canthal plane altered (Pre trauma pictures reveals pre existing mongoloid slant).

PERIORBITAL EXAMINATION: The patient had periorbital edema. There was single scar in forehead and obvious enophthalmos of right eye. On palpation, step deformity was felt in the right infraorbital rim.

INTRAORAL EXAMINATION: Occlusion was normal.

Donor site – No abnormality detected

RADIOLOGICAL INVESTIGATIONS:

- **PNS** shows disruption of right orbital floor and infra orbital rim.
- **Scan with 3-D reconstruction** showed similar findings

	Orbital Volume(cm^3)
Right orbit	27.380
Left Orbit	22.097

- Defect =2.2 cm^2

DIAGNOSIS:

Right orbit-Impure blow out # of floor,

Right zygomaticomaxillary complex #.

TREATMENT PLAN:

Orbital floor reconstruction with iliac cortical graft & Open reduction & internal fixation of the associated ZMC #.

OBSERVATION & RESULTS

In our study we operated 8 cases of Impure orbital blow out fractures with floor reconstruction with autogenous bone grafts from mandibular symphysis &Anterior iliac crest/medial cortex. All patients had impure blow out fracture of floor with infra orbital rim fracture, of which 4 patients had associated zygomaticomaxillary complex fracture. All the orbital floor fractures except 3 were treated within 6 weeks of trauma. The 3 cases included two post traumatic secondary deformities (2 years old) and 1 case was a 3 months old deformity.

The 8 cases were divided equally into 2 groups. Patients with defect of area less than 2 cm^2 and orbital volume expansion of less than 4.7 cm^3 were included under group I[2,67]. The remaining cases with defect greater than 2 cm^2 and volume expansion more than 4.7 cm^3 were included under group II[2,67].

All the cases were treated similarly via infraorbital approach / pre existing scar. The associated maxillofacial injuries like zygomaticomaxillary complex fracture were treated by reduction and fixation using stainless steel miniplate & screws. One case had a scar & contracture of upper eyelid with notching deformity, treated by scar revision.

The dropout rate (number of patient not responding to repeated recalls) was zero. All patients attended the follow-up.

PRE- OPERATIVE ORBITAL VOLUME/DEFECT ASSESSMENT

Pre operatively ,all patients underwent radiologic assessment of the orbit with Computed tomography scan using GE Discovery workstation 4.4 using volume viewer(installed application).

Using the CT scan, the dimension & area of defect was measured pre operatively .This gives a gross idea of the dimension of the graft required for reconstruction .

Using the CT scan (volume viewer), the volume of the orbits(affected & unaffected) are measured and the volumetric change identified.

- The merits of this procedure were:
  - ✓ Reduces intra operative time as preoperatively the size of graft required for reconstruction derived.
  - ✓ Helps to classify patients into the groups (volume of graft required less than 4.7ml can be reconstructed with mandible symphysis graft
  - ✓ No additional radiation exposure
- The demerits of this procedure were:
  - ☒ This method of volume determination showed high inter personal variation &less accurate as no standard landmarks used.
  - ☒ Time consuming
  - ☒ Additional expense

POST- OPERATIVE ASSESSMENT

The success of the surgical repair and post operative status was evaluated at periods of 1 week, 1 month and 3 months.

The reconstruction was evaluated using the following parameters:

1. Globe position & Facial symmetry
2. Diplopia charting
3. Graft rejection- follow up for 3 months
4. Post operative extra ocular movements
5. Post operative nerve (infra orbital) involvement
6. Wound infection/ dehiscence
7. Donor site morbidity
8. Overall patient satisfaction
9. CT - based orbital volume assessment

1. ***Globe position &Facial symmetry:***

The patients were assessed for globe position in 2 planes In frontal plane the success of correction of hypoglobus was assessed using the canthal plane as guideline. All 8 patients had satisfactory correction of hypoglobus. The degree of enophthalmos correction was assessed clinically in Worm's view/ Hertel exophthalmometry (in cases applicable).The same assessment was also done using CT scan axial, coronal & sagittal sections .When compared to pre operative values ,except for 2(cases 7,8) enophthalmos was corrected satisfactorily to less than 1 cm^3 difference.*(TABLE 2)*

2) *Diplopia charting*:

All patients were assessed for diplopia post operatively and charted .Pre operatively 3 patients had symptomatic binocular diplopia. Diplopia resolved in all 3 patients post operatively between 4th day and 2nd week. All except 1 (case 8) had persisting diplopia in extreme upward gaze.(TABLE 1)

3. *Graft rejection:*

In the follow-up period of 3 months there were no signs or symptoms of graft rejection.

4. Post operative extra ocular movements:

Pre operatively 2 patients had limited ocular movements mainly in upward gaze. Both patients showed improvement in ocular movements post operatively.

5. Post operative nerve (infra orbital) involvement:

Pre operatively all except 3 patients had infra orbital nerve paraesthesia. Post operatively 3 patients showed gradual improvement between 1st to 4th week. Two patients had persistent infraorbital nerve paraesthesia which took 3 months to resolve. (TABLE 1)

6. Wound infection/ dehiscence:

In the 1st post operative week, wound healing in all surgical sites were satisfactory with no signs of infection or hemorrhage.

7. Donor site morbidity:

Group I-All the patients showed no evidence of mobility, loss of vitality, gingival recession of the lower anterior teeth. Esthetically, no change in chin contour or drooping of chin was noted**.**

Group II- All the patients showed no evidence of Meralgia paresthetica, hematoma or gait disturbance. All patients became comfortably ambulatory in 48 hours**.**

Donor sites showed uneventful healing in all 8 cases. There was neither aesthetic deformity of chin nor functional deficit of lower limbs/ abdomen.

8. Overall patient satisfaction :

At the follow up examination none of the patients reported experiencing problems like infection, migration or extrusion of graft, which might have indicated complication. One patient, post operatively had epiphora for 3 days which resolved spontaneously. All except 1 patient (case 8) were satisfied with the outcome of the surgery.

9. .CT based orbital volume assessment:

At the 3rd post operative month, all patients underwent radiologic assessment of the orbit with Computed tomography scan using GE Discovery workstation 4.4 using volume viewer (installed application).

The results (Table 2) of the CT based study showed,

- Orbital volume changes of less than 2cm^3 can be effectively reduced as in Group I cases.
- Orbital volume changes of more than 4.5 cm^3 could not be effectively restored in spite of using larger iliac graft as in Group II.
- Earlier the volumetric restoration, better the results.
- The average density of the graft was higher in group I than group II. This could be a result of inherent high density of the mandibular graft than iliac graft, or the higher resorption of the iliac graft than mandibular graft .This can be confirmed only by further long term follow up of the cases.

TABLE 1

S:NO	PATIENT NAME/AGE/SEX	TREATMENT	PRE OPERATIVE FINDINGS				
			DIPLOPIA	ENOPTHALMOS	IO NERVE PARAESTHESIA	EYEBALL RESTRICTION	VISUAL ACUITY
1	Mr.Rishu raj 21/M	FLR with MSG	_	+	+	_	6/6
2	Mr. Vimal 19/M	FLR with MSG. Scar revision	_	+	+	_	6/6
3	Mr. Anbarasan 23/M	FLR with MSG, ORIF for rt. ZMC #	_	+	_	_	6/6
4	Mr. Sakthivel 28/M	FLR with MSG, ORIF for rt. ZMC #	_	+	+	_	6/6
5	Mr. Santhosh 23/M	FLR with ICG, , ORIF for lt. ZMC #	+	+	+	+	6/6
6	Mr. Raja 25/M	FLR with ICG. Open rhinoplasty, Malar AUG.	+	+	_	+	6/6
7	Mr. Vel murugan 38/M	FLR with ICG	_	+	_	_	6/6
8	Mr.Richard 21/M	FLR with ICG, ORIF for rt. ZMC #	+	+	+	_	6/6

FLR-Floor Reconstruction, MSG- Mandibular Symphyseal Graft, ICG-Iliac Crest Graft ,ORIF- Open Reduction & Internal Fixation, ZMC-Zygomaticomaxillary complex, AUG-Augmentation.

TABLE 2

S:NO	PATIENT NAME/AGE/SEX	UNAFFECTED SIDE OV(cm^3)	AFFECTED SIDE PREOPERATIVE OV(cm^3)	POST OPERATIVE OV(cm^3)	PRE- OP OV CHANGE (cm^3)	POST-OP OV CHANGE (cm^3)	GRAFT DENSITY (Hounsfield) @3months
1	Mr.Rishu raj 21/M	29.305	30.969	29.517	1.664	0.212	968.29
2	Mr. Vimal 19/M	20.015	23.883	20.772	3.868	0.757	1113.1
3	Mr. Anbarasan 23/M	22.462	24.333	22.764	1.871	0.302	1281.2
4	Mr. Sakthivel 28/M	20.348	21.472	20.503	1.124	0.155	1734.5
5	Mr. Santhosh 23/M	25.098	30.103	26.227	5.005	1.129	658.79
6	Mr. Raja 25/M	26.438	31.852	27.728	4.414	1.290	651.36
7	Mr. Velmurugan 38/M	29.395	34.320	30.624	4.925	1.229	671.0
8	Mr.Richard 21/M	22.097	27.38	23.494	5.283	1.397	773.2

OV – Orbital volume

DISCUSSION

The scientific discussion regarding the treatment of orbital floor blow out fractures concerns indications, timing and above all modalities of intervention. Characteristic symptoms of internal orbital wall fracture are enophthalmos, hypophthalmos, and diplopia, due to increased orbital volume and injury and displacement of the periorbital soft tissue[55]. To avoid these problems, the prolapsed soft tissue must be repositioned and the internal orbital walls should be accurately reconstructed[37].

Correction of hypoglobus is technically easier than enophthalmos, because enophthalmic correction requires a wide, deep subperiosteal dissection and implant positioning, posterior to the equator of the globe, with the inherent risk of orbital apex injury[37]. The material used for wall reconstruction should be readily available, easy to mold, easy to anchor, biocompatible, noncarcinogenic, and strong. If it is resorbable, it should be osteogenic, osteoconductive or osteoinductive. The choice of a particular material is dependent on several factors. These include surgical access, the size of the defect to be repaired, donor site morbidity, quantity and quality of available bone and the surgeon's experience.

In general, an ideal material is one whose properties most closely replicate these of the tissue it replaces. Because the orbit is

made of bone, it might seem logical to replace bone with bone. Autogenous bone is popular for internal orbital reconstruction and it has low infection rate. Autogenous bone grafting has been the gold standard to provide frame work for facial skeleton and orbital rim. Bone is strong, biocompatible, osteogenic, osteoconductive, and osteoinductive. Many different sources such as Calvarium, Ribs**,** **Iliac crest**, anterior wall of Maxillary antrum, **Mandible,** Zygoma have been used.

Iliac bone is easy to harvest, and the medial cortex of the anterior iliac crest is relatively easy to shape to fit the internal orbital wall[54,65]. Few studies are available concerning immediate wall fracture reconstruction with iliac bone. According to these studies, good aesthetic and functional results can be achieved[18,54, 55,58,65].

The mandibular symphysis is a more accessible region for graft harvesting in the mandible compared to the lingual plate and ramus. Additionally the contour of the bone graft conforms to the orbital floor quite readily. This has been previously shown by Bagatin, who reconstructed 6 orbital floor defects with mandibular symphyseal bone grafts. Grafts measuring 2 to 4 cm can be harvested from the symphysis. Grafts of this dimension find application of orbital floor defects[14,68].

The main advantage of using a local donor site like mandibular symphysis is convenient surgical access, reduced operative and anaesthesia time, transoral approach that does not result in cutaneous scar thereby decreased morbidity[20]. Nevertheless it had its own limitations which mainly included the amount of bone available, contraindicating its use in orbital volume change of more than 4.7 ml^2.

Harsha (1986) suggested that the morbidity associated with the removal of bone from the traditional donor sites such as Ilium, Calvarium, Rib are often greater than that associated with the facial surgery per se. Partly based on this assumption the harvesting of mandibular bone grafts has gained importance and encouranged by the higher osteoinductive property of a membranous bone graft (mandible) Vs a bone graft from endochondral site (Ilium)[28,36].

Bone Remodeling:

The long-term criteria for successful internal orbital wall reconstruction are restoration of the position of the globe and recovery of binocular vision without diplopia. These outcomes are achieved by reconstructing the orbital walls accurately and restoring the orbital volume[8,12,56].The advantages of using autogenous bone as reconstruction material are its biocompatibility and osteogenic, osteoconductive, and osteoinductive capacity[56,60]. The bone is also

rigid enough to support orbital soft tissue. The drawback is its unpredictable resorption[28,55].

Membranous bone taken from the cranium or facial skeleton is clearly superior to rib or iliac crest when used as bone autografting material to the craniofacial skeleton. In both clinical and experimental setting ,membranous bone grafts maintain their volume ,whereas endochondral grafts undergo an unpredictable amount of bone resorption[36] . Joseph.F.Kusiak in an experimental study demonstrated early rapid vascularization of membranous bone grafts compared to endochondral grafts, an important factor in graft survival[28]. In the orbits in which the orbital volume had increased excess of 8ml, the position of the graft should be caudally placed, which suggests that overcorrection could be beneficial[55].

Position of the Globe:

The principal mechanism of posttraumatic enophthalmos and hypophthalmos is enlargement of the bony orbit's volume. However, loss of ligament support, fat atrophy, and scar contracture may also lead to similar symptoms[37].Ellis and Tan[18] suggest that enophthalmos persist if the bone graft was placed too anteriorly. The study by Iatrou et al. revealed that hypophthalmos occurs in the most severe cases despite moderately good bone graft reconstruction[55]. They suggested that this was due to unfavorable bone resorption. Dempf et al. reported a 30 percent hypophthalmos

rate after orbital wall reconstruction, although the reconstruction was rated as poor in only 2 percent[55]. Despite a moderate radiological result, the clinical outcome was not satisfactory. This was pertinent to our case 8.

Diplopia

The most commonly accepted cause of diplopia is entrapment of the extraocular muscle (inferior rectus muscle) or its fascia in the fracture gap in the orbital floor[15]. Another plausible cause is injury to the extraocular muscles or nerves[16]. It seems that diplopia correlates better with severity of the orbital injury than with change in the orbital volume. Clinical results published in the literature with different surgical or nonsurgical approaches seem to be similar; diplopia was seen after follow-up in approximately 5 to 15 percent of the patients, whereas the incidence of diplopia in the central field of vision was, naturally, lower[55]. In our study, diplopia (upward gaze) occurred in 1 patient with persisting enophthalmos and supra tarsal hooding. Delay of the operation did not affect the occurrence of diplopia [37]. Patient with diplopia since trauma 2 years back recovered completely following surgery.

Donor Site

Donor-site morbidity rate in the iliac crest area seems to be low. A study by Banwart et al[55] revealed that none of the 261 patients studied had a severe intra operative complication; none of

the 225 patients with long-term follow-up had a severe late complication. The authors concluded that severe complications from harvest of the iliac crest bone graft can be avoided and that major complications that affect functioning are uncommon. Ahlmann et al[1] had similar results in their study. The present study is in accordance with these results. The main complication was skin scar.

Although the complication rate seems to be low, donor-site complications should not be ignored. In 1945 Oldfield , first reported the herniation of abdominal contents through full thickness defect in the Ilium, occurring in up to 5 % of the cases. Comparing the two grafts the mandibular symphysis has been advocated recently as superior to iliac Graft as its donor site morbidity is less.

When bone grafts from the mandible have been used for repair of orbital floor defects, there has been no incidence of their loss attributable to infection. This has also been our experience. This may be a result of use of pre and peri-operative antibiotics as well as the vascularity in maxillofacial region. There should be no objection to harvest a bone graft from the contaminated oral cavity and placing it in the orbital floor.

SUMMARY & CONCLUSION

Fracture of the Orbital floor is an entity that occurs in various presentations. The fracture causes orbital contents to herniate into the shock absorber-maxillary sinus thus preventing globe perforation. This safety mechanism leads to Enophthalmos- a very difficult deformity to correct. In addition, the fracture may cause extra ocular muscle entrapment and restricted eyeball mobility that severely disables the eyeball movements. In cases with such orbital signs and symptoms early surgical intervention is necessary which very often mandates the use of autogenous or alloplastic material to reconstruct the orbital floor defect.

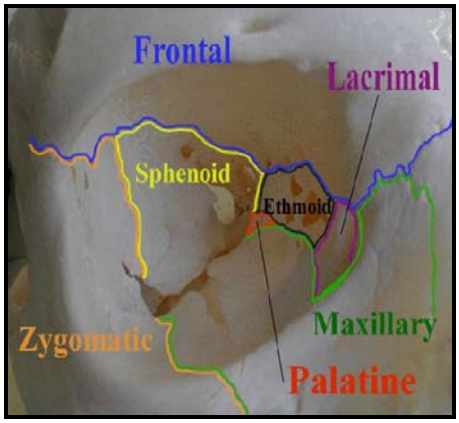
In the Department of Oral & Maxillofacial surgery, The Tamilnadu Government dental college & Hospital , we have treated 8 cases of impure blow out fracture of orbital floor under 2 groups. Group 1 patients with floor defect of less than $2cm^2$ &orbital volume increase of less than 4.71 ml (calculated based on CT Scan) were treated with floor reconstruction using a local graft-membranous bone, the mandibular symphysis graft .Group 2 patients with floor defect of more than $2cm^2$ & orbital volume increase of more than 4.71 ml (calculated based on CT Scan) were treated with floor reconstruction using an endochondral bone-iliac crest cortical grafts. All patients with associated Zygomatico Maxillary complex fractures were treated appropriately –reduction via Dingman approach and direct fixation.

When reviewed at 3rd month post operatively, the bone grafts were well visualized with computed tomography imaging. At 3 months follow-up, computed tomography demonstrated that the middle section of the orbital floor was well elevated in all 8 orbits. All grafts were still in situ by ,with density measured in Hounsfield units revealed the Mandible Symphyseal graft on higher side. This statement requires further justification only with further comparative follow up in subsequent months.

From our results of 8 cases, we conclude that the mandibular symphysis graft is a good simple reconstructive option in small orbital floor defects with orbital volume change of less than 4.71 ml. Larger defects with huge orbital volume changes require increased volume of graft, where Iliac graft is versatile. Albeit, Enophthalmos of long duration with orbital volume change exceeding $4cm^3$ is difficult and unpredictable. Among our cases, the cases receiving early treatment showed satisfactory correction of Enophthalmos. These cases require further radiologic follow up to support the higher density and reduced resorption of the membranous bone-Mandible symphysis compared to the endochondrally ossified bone-Iliac cortical graft.

COLOUR PLATE-I

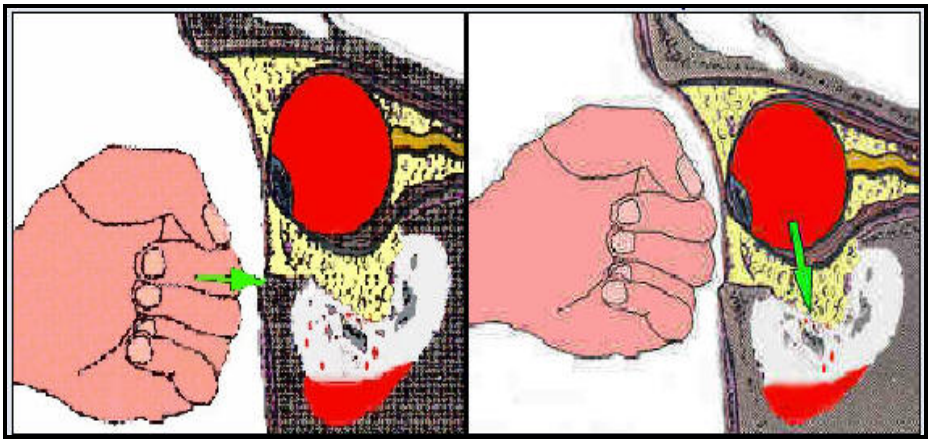
Bony orbit



Hammer's Key area

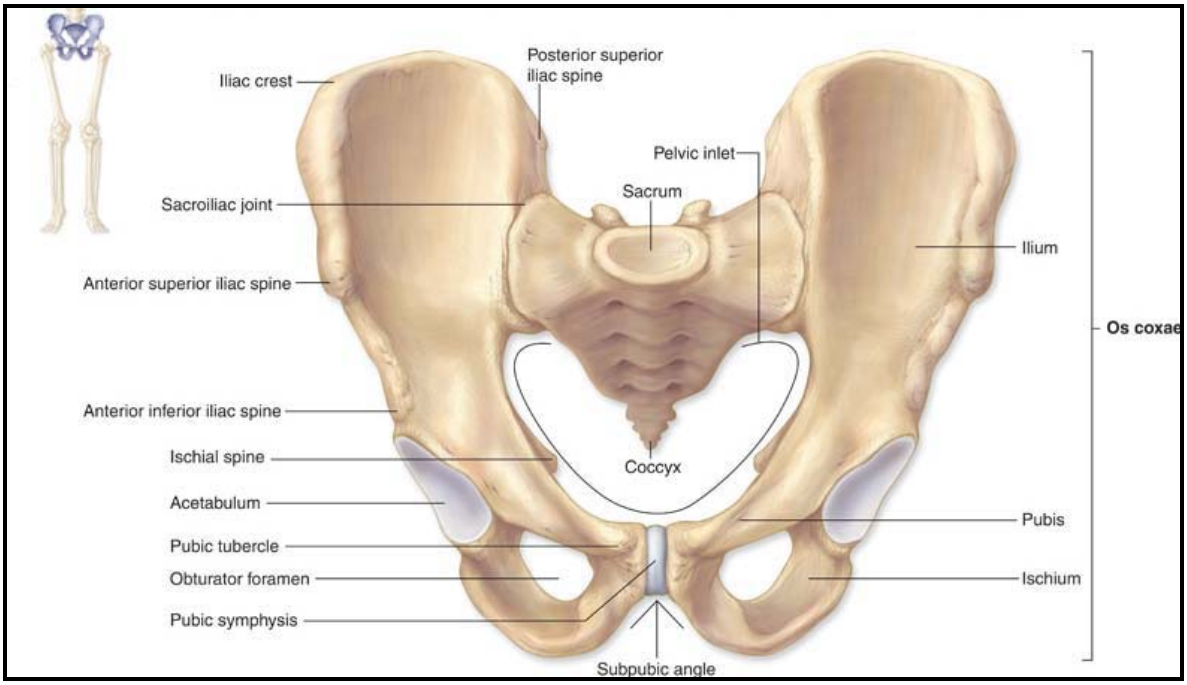
<u>Biomechanics of Orbital blow out #:</u>

Buckling theory ***Retropulsion theory(Smith & Regan)***

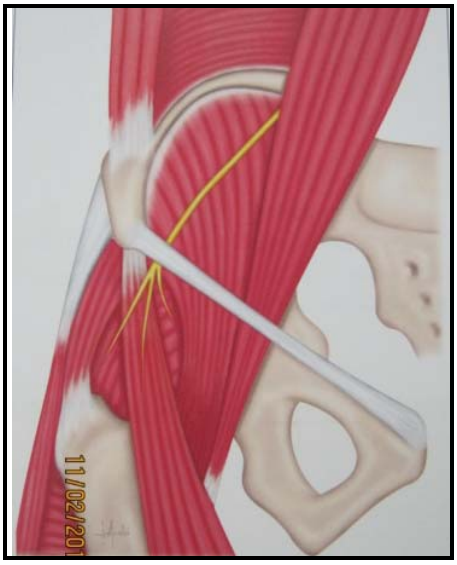


COLOUR PLATE-II

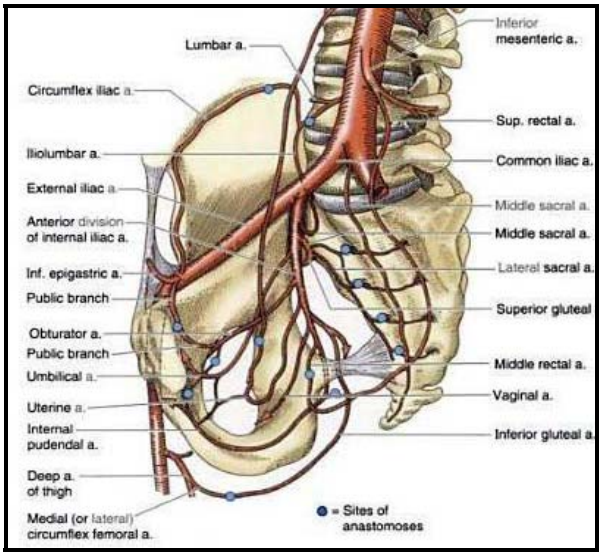
SURGICAL ANATOMY OF ILIAC REGION



Muscle& ligament attachments

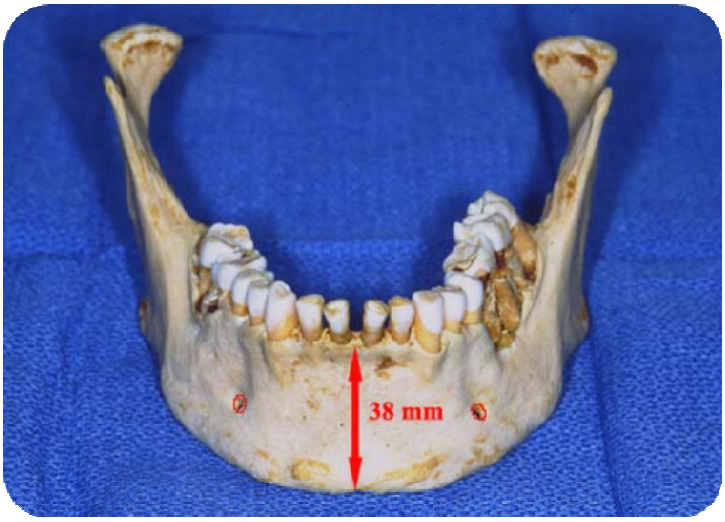


Arterial supply to Anterior Iliac Crest Region

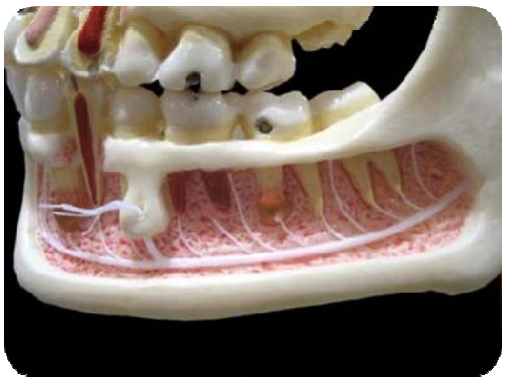


COLOUR PLATE -III

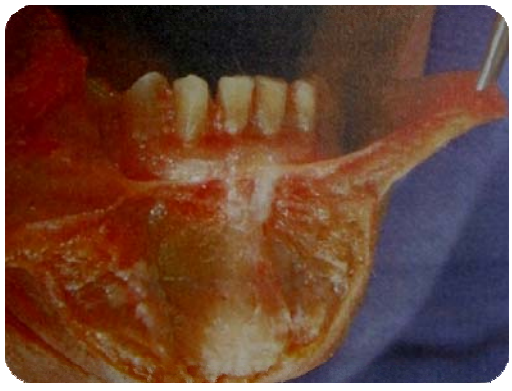
SURGICAL ANATOMY OF MANDIBULAR SYMPHYSIS:



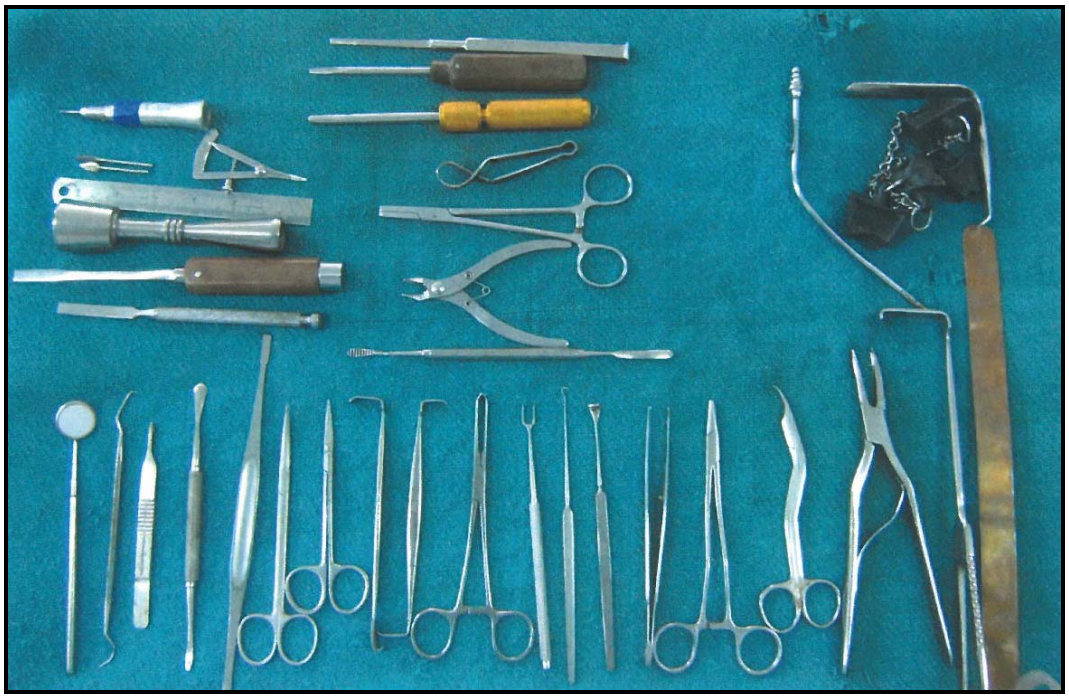
Nerve supply



Muscles attached to mandible symphysis



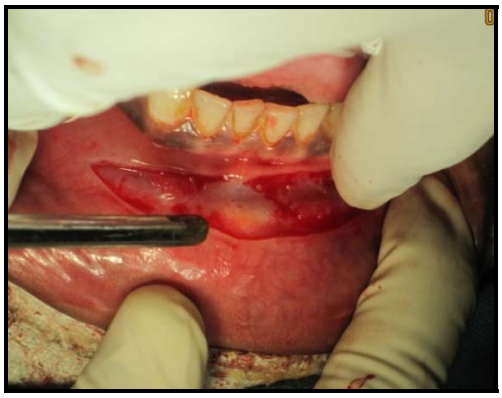
ARMAMENTARIUM



COLOUR PLATE- IV

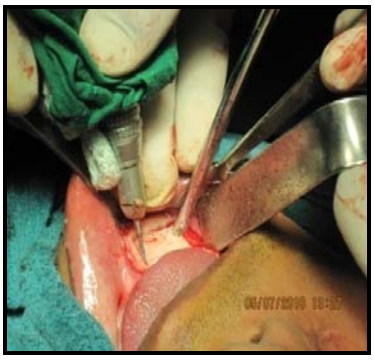
Infiltration Of Vasoconstrictor

Mucosal Incision



Degloving of mandibular symphysis

Osteotomy cuts made with 702 fissure bur



Graft harvested with curved osteotome

Harvested Graft

Primary closure with 3-0 vicryl

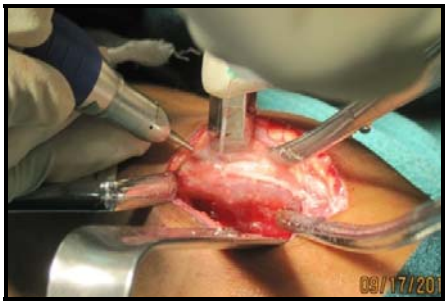
COLOUR PLATE- V

Marking of incision

Incision & layerwise dissection

Exposing Crest and inner cortex

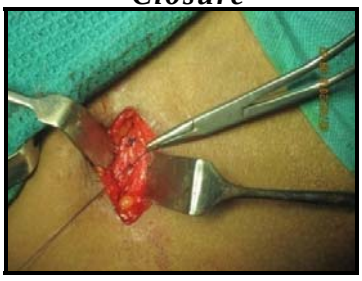
Osteotomy cuts using 702 fissure bur



Graft harvested with curved osteotome

Harvested graft

Layerwise Primary Closure



Skin Closure

COLOUR PLATE- VI

Skin Incision- Infra Orbital

Layerwise Dissection

Periosteal Incision

ORIF:***Associated ZMC #***

Harvested graft placed in the orbital floor defect

Periosteal closure

Subcuticular suture with 6-0 Prolene

Case report 1

Frontal View- Pre Op

Post Op

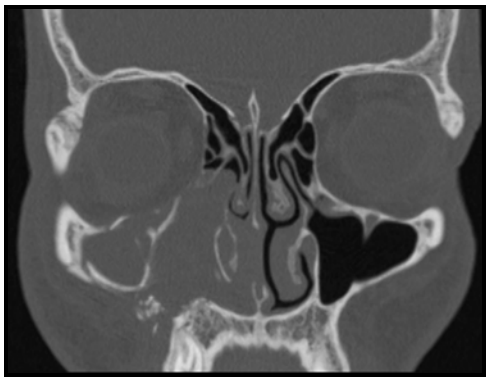
Worm's View- Pre Op

Post Op

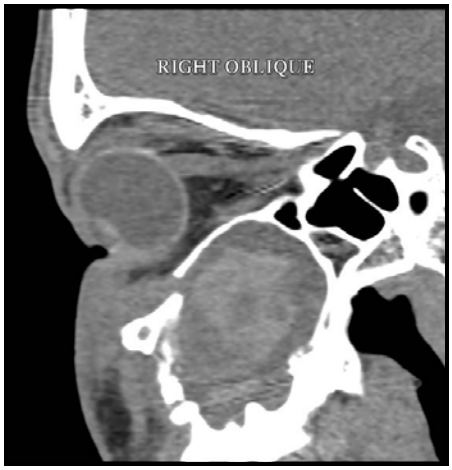
X-ray PNS View – Pre Op

Post Op

CT Coronal View – Pre Op **Post Op**



CT Sagittal view - Pre Op **Post Op**



Case report 2

Frontal View- Pre Op

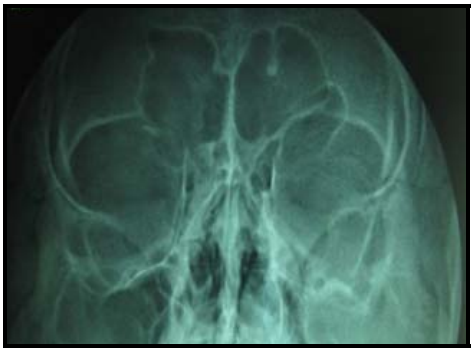
Post Op

Worm's View- Pre Op

Post Op

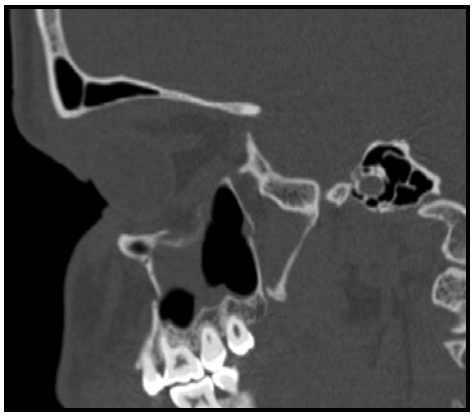
X-Ray PNS View- Pre Op

Post Op

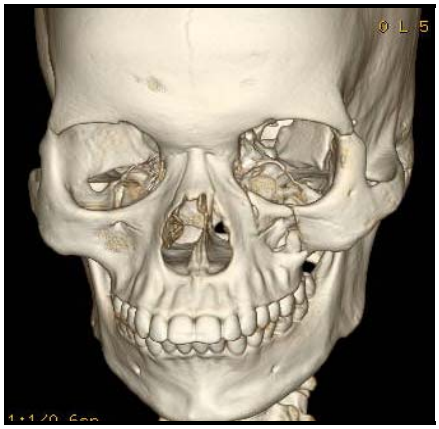


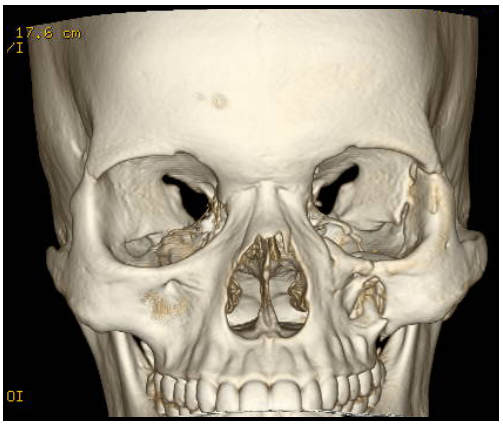
CT Coronal View – Pre Op **Post Op**

CT Sagittal View- Pre Op **Post Op**



CT 3D Reconstruction – Pre OP **Post Op**





Case report 3

Frontal view –Pre Op

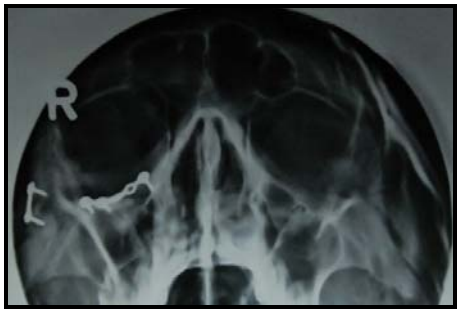
Post Op

Worm's view –Pre Op

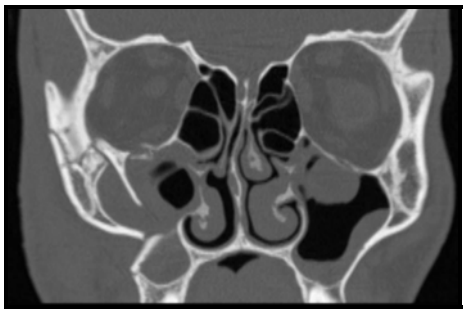
Post Op

X-Ray PNS View- Pre Op

Post Op

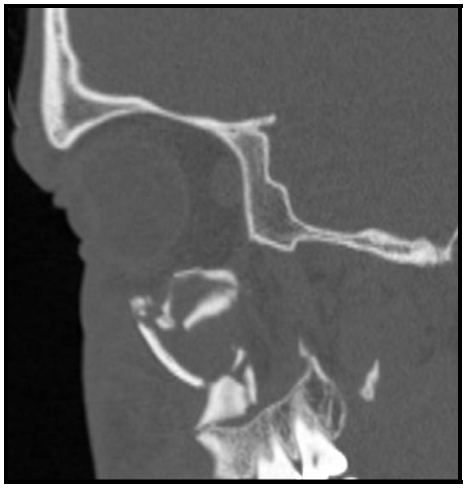


CT Coronal view–Pre Op

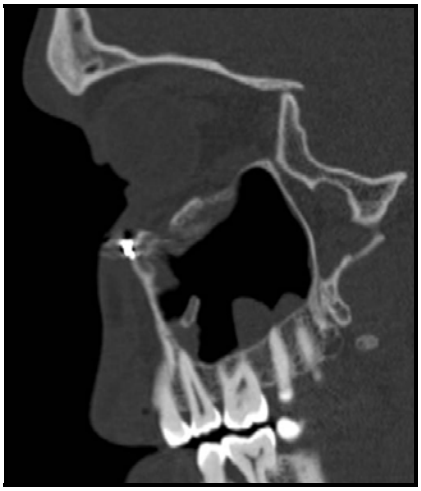


Post op

CT Sagittal view-Pre OP

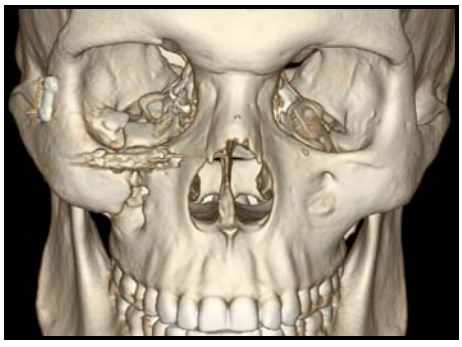


Post op



CT 3D Reconstruction – Pre OP

Post Op



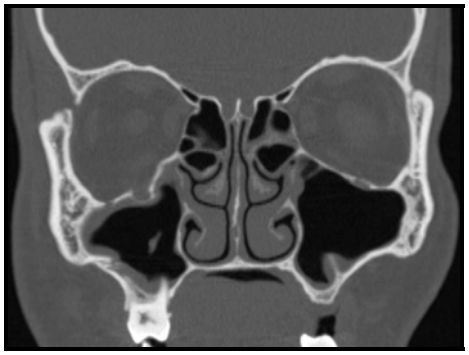
Case report 4

Frontal view-Pre Op ***Post Op***

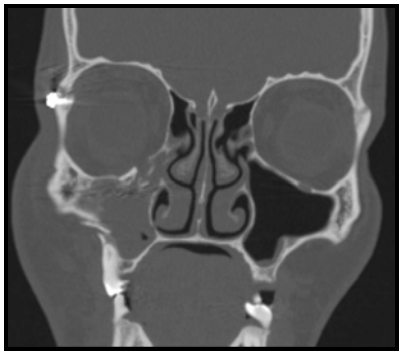
Worm's view –pre Op ***Post Op***

X ray PNS view –Pre Op ***Post Op***

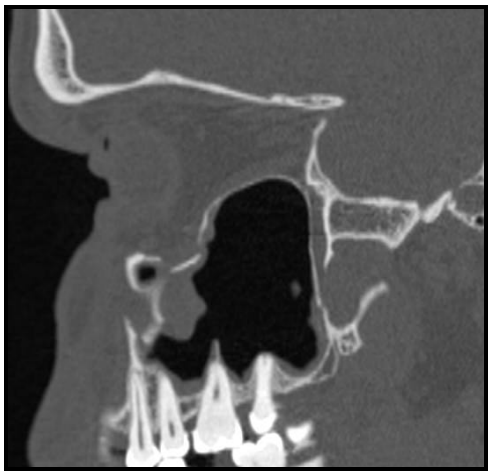
CT Coronal view-Pre Op



Post op



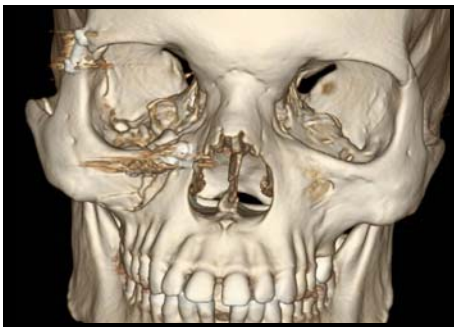
CT Sagittal view –Pre Op



Post Op

3D reformatted –Pre Op

Post Op



Case report 5

Frontal view – Pre Op

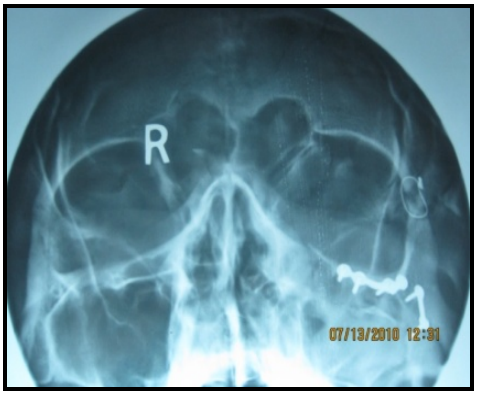
Post op

Worm's view-pre Op

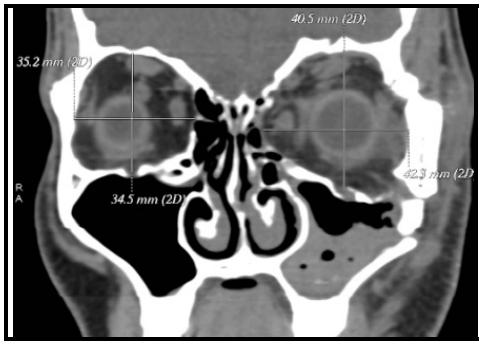
Post Op

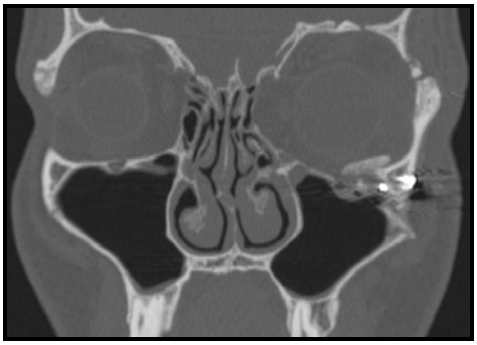
X ray PNS view –Pre Op

Post op

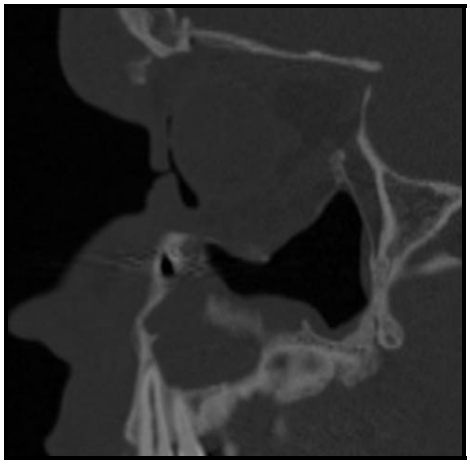


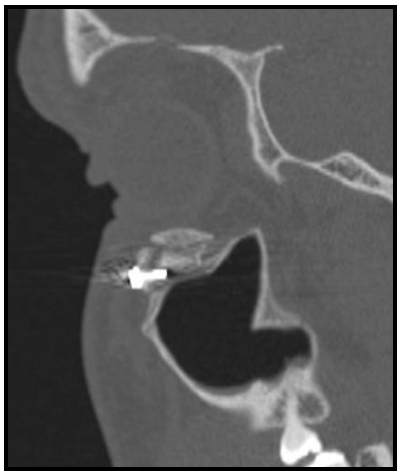
CT Coronal view-Pre Op ***Post Op***





Sagittal view pre Op ***Post Op***





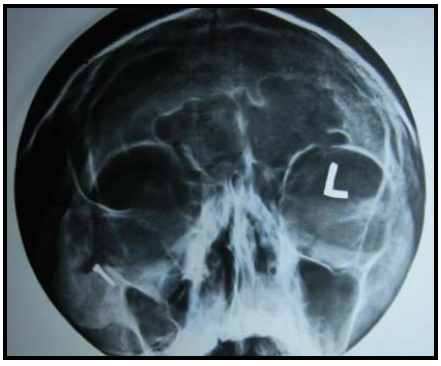
3D reformatted –Pre Op ***Post Op***

Case report 6

Frontal view – Pre Op ***Post Op***

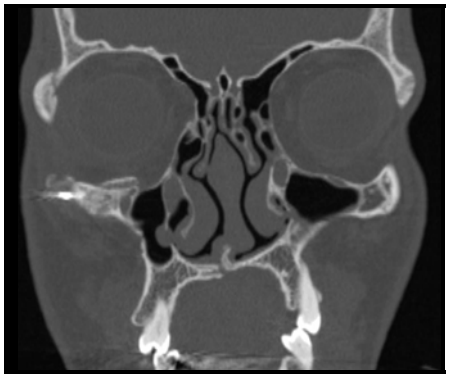
Frontal view – Pre ***Post op***

X ray PNS view -Pre Op ***Post Op***

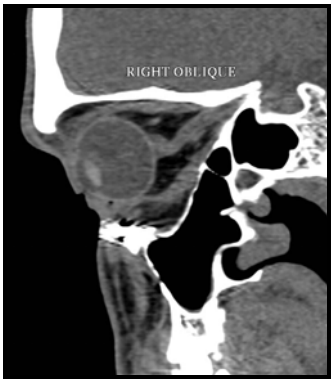


CT Coronal view – Pre Op

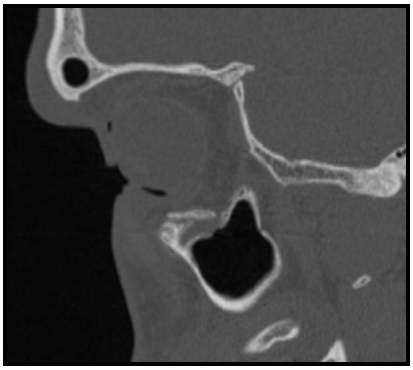
Post Op



CT Sagittal view – Pre Op



Post Op



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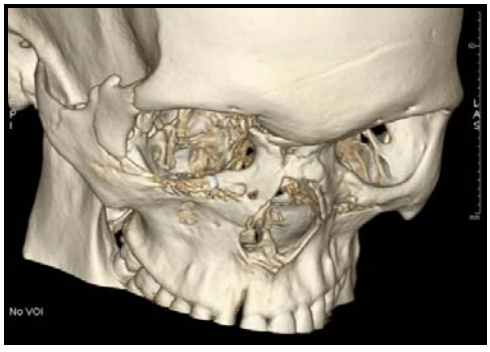


Post Op

Case report 7

Frontal view –Pre Op

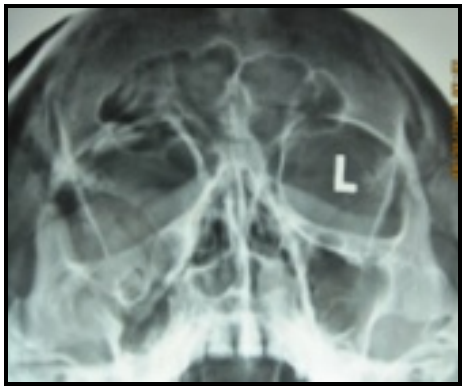
Post op

Worm's view –Pre Op

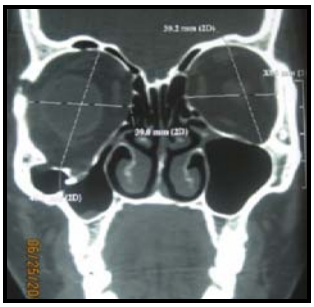
Post op

Xray PNS view –Pre Op

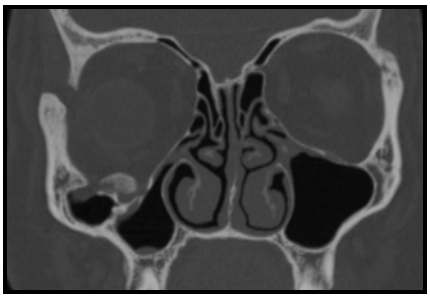
Post Op



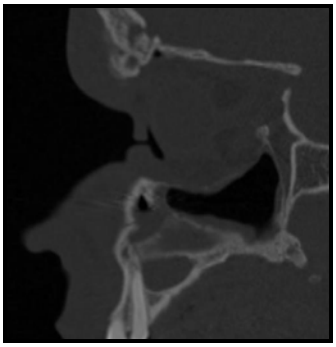
CT Coronal view –Pre op



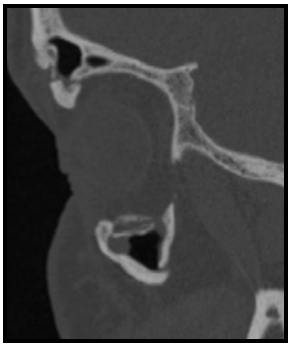
Post Op



Sagittal view –pre Op



Post Op



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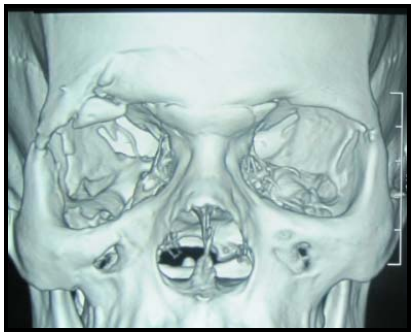
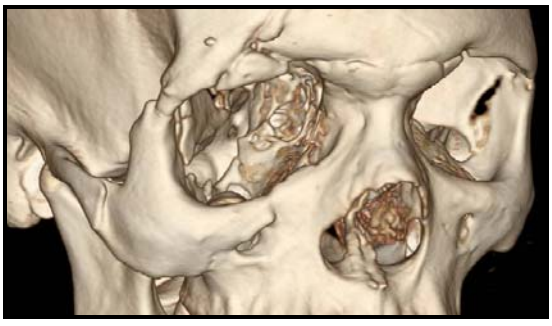


Post Op



Case report 8

Frontal view –Pre Op

Post op

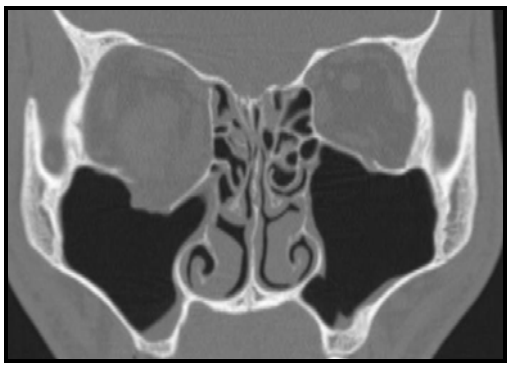
Worm's view – Pre Op

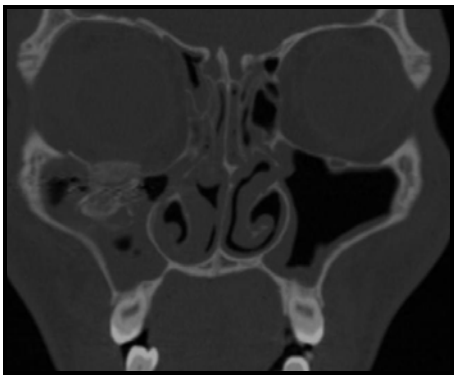
Post Op

Xray PNS view –Pre Op

Post Op

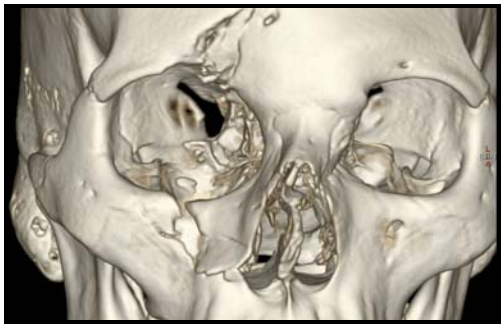
CT Coronal view – Pre op ***Post Op***





CT Sagittal view – Pre Op ***Post Op***

3D Reformatted Pre Op ***Post Op***



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INFORMED CONSENT

Study title:- MANDIBULAR SYMPHYSIS GRAFT VS ILIAC CORTICAL GRAFT IN RECONSTRUCTING FLOOR IN ORBITAL BLOW OUT FRACTURE -A COMPARITIVE STUDY

Patient's Identification No:_____ Patient's Name: _____
Patient's Date of Birth : ___/ ___/ _____

I confirm that I have read and understood the Information sheet for the above study. I have had the opportunity to ask the questions and all my questions and doubts have been answered to my complete satisfaction.

I understand that my participation in the study is voluntary and that i am free to withdraw at any time , without giving any reason without my legal rights being affected.

I understand that clinical study personnel , the Ethics Committee and the regulatory Authorities will not need my permission to look at my health records both in respect of the current study and any further research that may be conducted in relation to it , even if I withdraw from the study. I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published, unless as required under the law . I agree not restrict the use of any data or results that arise from this study.

I agree not to withhold any information about my health from the investigator and will convey the same truthfully.

I agree to take part in the above study and to comply with the instructions given during the study and to faithfully co-operate with the study team , and to immediately inform the study staff, if I suffer from any deterioration in my health or well- being or any unexpected or unusual symptoms.

I am well informed that a small portion of bone will be taken either from my lower jaw or hip bone for covering the defect in the bone fractured beneath my eye. I know the potential complications that can arise during and after the surgery.

I hereby consent to participate in this study and I understand that I will be treated with Surgical Procedure under general anaesthesia.

I consent to give my medical history , undergo complete physical examination and diagnostic tests including haematological , biochemical and urine examination etc.

I agree to take part in this study as a research participant. By my signature I affirm that I am at least 18 year old & I have received a copy of this consent form.

Signature/ Thumb Impression of the Patient : _____ Place __ Date:____

Patient's Name & Address:
_____
_____

Signature of the Investigator:_____ Place: _____Date:_____

Study Investigator's Name: _____

Institution:_____

*Signature of the witness_____Place :_____Date:_____

*Name and Address of the Witness :
_____

**** Mandatory for uneducated patients (where thumb impression has been provided)***